ESTIMATING BUILDING COSTS AND APPRAISING BUILDINGS

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ESTIMATING BUILDING COSTS AND APPRAISING BUILDINGS

BY

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PREFACE

The fundamental purposes of this book are three-fold, (1) to aid the contractor or estimator in determining the amount of labor required for the various building operations; (2) to furnish him with prices of labor and materials which will enable him to check his estimates and (3) to equip him with full data on the present day costs of replacing various types of existing buildings built between 1890 and 1923 which will serve both as the basis of appraisals and as checks and guides in estimating similar buildings.

The author does not advise using the prices in this book for any but approximate or rough estimating. They are for the purpose of giving a general idea of present day costs. Some of them will have changed before this book is off the press. Local conditions will also tend to affect the cost of the work, but having the labor hours and the bill of materials, it will be a simple matter to apply local prices to obtain an accurate estimate of any type of building construction.

Contractors when preparing bids are usually working under pressure in order to have them in the hands of the architect or owner before the hour set for opening the bids. It has been the constant effort of the author, therefore, to arrange the data for quick, easy reference, putting them in the form of tables whenever possible and omitting detailed descriptions except as these are necessary to illustrate the use of the tables.

An estimator, in order to use properly such information as that given in this book, should be thoroughly familiar with the methods of installing the various kinds of building material. With this in mind, detailed descriptions are given of the installations of many kinds of material. In some cases these are in the form of specifications, while in others they have been written up as a general description of the work.

Frequently the specifications for building work hold the contractor responsible for the strength of certain parts of the work such as floor and roof construction. Estimators are also obliged to

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design and estimate the cost of falsework and temporary construction for practically every large job for which they prepare a bid. This requires a knowledge of the strength of the more common kinds of building material. For this reason a limited amount of designing data has been included which will be of assistance in such cases.

Chapter XXVIII "Appraisal of Buildings," while especially adapted to the use of appraisers, insurance adjusters, dealers in real estate, etc., should also be helpful in checking estimates for new work. This chapter contains the tables prepared by a committee of railroad valuation engineers. These tables give the actual present day construction costs of numerous types of buildings built between 1890 and 1923. They show the percentage of increase in the cost of buildings for the entire period. A contractor often knows the actual cost of some other building which is similar to the one for which he is preparing a bid, but which may have been built some years previous when prices were quite different. It is easy, however, by the use of the tables in this chapter to make a comparison of the cost of the two jobs and the estimate for the new work can thus be checked.

F. E. Barnes.

New York, N. Y.
March, 1924.

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The data in the chapter on "Appraisal of Buildings" was prepared by a committee of railroad valuation engineers. The committee consisted of the following men: E. Cummings, Lehigh Valley R. R.; E. M. Killough, Western Maryland Ry.; D. W. Riley, Pennsylvania System; W. D. Sigler, Erie R. R.; J. J. Vail, Pennsylvania System; W. C. Van Duyne, New York Central R. R.; O. G. Wilbur, Baltimore and Ohio R. R.; the author being chairman of the committee. It was only through the splendid assistance given and the vast amount of work performed by the various representatives of the committee that the securing of the data in this chapter was made possible. In addition to those mentioned, no less than twenty-five general contractors have rendered valuable assistance, especially on the subject of the amount of building material that can be installed per hour or day by mechanics in the various building trades.

The author would appreciate criticisms or suggestions concerning any information given in this book.

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ESTIMATING BUILDING COSTS AND APPRAISING BUILDINGS

CHAPTER I

ESTIMATING

GENERAL INSTRUCTIONS FOR ESTIMATING

It is not possible to give exact rules for estimating, but a few suggestions may be helpful. The estimator should become familiar with the plans and specifications before starting to take off quantities. He should note apparent omissions or inconsistencies. It does not pay to worry much about these, however, until it is certain that they are not explained elsewhere in the plans or specifications. In general the specifications take precedence over the general plans, and full size or large scale details over the specifications. Before pricing a job of importance, one ought always to visit the site. This visit should follow and not precede the study of the plans and specifications. It would be still better to complete the estimate sufficiently to enable one to list the information required. The following are some of the queries that can be answered by such a visit.

1. What buildings or other obstructions will have to be removed, and what will be the cost for clearing the site?
2. What is the nature of the soil? Is it easy or hard to handle, and will sheet piling be necessary?
3. Is the location wet or dry, and if wet, what will be the cost of pumping and bailing?
4. Are there adjoining buildings that will have to be shored or underpinned?
5. How far is it to a suitable dump for excavated material, and over what kind of roads?

6. Is there available storage space for materials at the site, and does this space have to be hired?
7. Will it be necessary to build board walks or overhead bridges or enclosing fences, and if so for what length, and what will be the width of the walks and bridges?
8. How far is it to a siding where shipments will be received, and what is the nature of the roads?
9. Where will suitable sand, gravel, broken stone, rubble stone, brick, lumber and other such materials be obtained? Can they be bought locally, and if so at what price?
10. Is there a sufficient number of teams or auto trucks available locally, and at what rate per hour or day?
11. How about the labor market? Can building laborers be had locally? If not, will those coming from elsewhere be able to find board and lodging, or must quarters and commissaries be provided?

General Form or Order of an Estimate.—The best order to follow in making an estimate is in general the order of construction, starting with excavating and finishing with such items as painting, hardware, etc. It is, however, very desirable where there is a good specification to follow the order given in the specification as there is much less danger of omitting items when this is done. When possible the estimator for the general contractor should use a checking pencil and check off each item as it is recorded. It is a good plan to use pencils of two or three colors for this purpose; as for example, red for brick and other kinds of masonry, yellow for lumber and kindred trades, and black for steel. It is important that these check marks should be small, and be placed exactly on the item for which they are intended, as otherwise they may do more harm than good.

The estimate should be made on suitably ruled, padded estimating paper, and each item should be completed before starting the next. When the quantities are extended, each item should be carried out and the total for each kind of material carried to the summary sheet for pricing. By this method when an error is found, or when any change is made in the plans or specifications, the correction or change can be made very easily, and will be carried directly to the summary sheet at once, and does not require the changing of the

footings through all the other sheets of the estimate, with the possibility of making additional errors while correcting one. Each item should be priced at its exact cost without overhead or profit. At the end of the estimate, add overhead and profit for the entire job. This is much better than to add overhead and profit to each item. When the contract is secured, it is important to keep a careful and accurate record of the cost in as much detail as possible, so as to check the estimate and gain experience for use in bidding on other similar jobs.

Sub-bids should be made out "according to plans and specifications." Do not permit them to be made out on a list as it is enough for the general contractor to assume the risk on his own work and not carry such risks for sub-contractors on their parts of the work.

Making Extensions and Checking the Estimate.—When there is enough work, it is best to have the extensions made by an expert calculating machine operator, but even for small offices there are certain kinds of machines which can be operated with economy by the estimator himself, especially for multiplying and dividing. Extensions and numerical calculations are best made by one person and checked by another. Every possible method of eliminating errors both in the estimate and in the extensions should be resorted to. It is well when possible to compare the complete estimate with that of other jobs of a similar nature, and finally, it is advisable to have the estimate given a general examination by the chief engineer or someone who has not assisted in its preparation. Correct estimates, properly priced, are absolutely essential if the contractor is to continue in business.

OVERHEAD EXPENSE AND PROFIT

General Conditions.—Overhead expenses have frequently been overlooked in the past, and are even now receiving far too little attention by many contractors. They consist of such items as:

Compensation and liability insurance
Fire and tornado insurance
Contractor's bonds
General office expense
Traveling expense
Use of tools and equipment

Field supervision
Job office, cement sheds, etc.
Photographs
Repairing streets and pavements
Building and other permits
Removing rubbish and cleaning up
Cutting for other trades.

Workmen's Compensation Insurance.—This covers the employer's obligation to pay workmen's compensation to their employees or dependents for damage on account of personal injuries. Most of the states have passed Workmen's Compensation Laws and are known as Compensation States. The law of each state provides for the amounts to be paid in case of injury or death. The rates shown are varied in accordance with the laws of the different states, naturally being high in the states where the benefits allowed are large and where the past experience has produced a high loss ratio. There is no limit of liability in Compensation States except in the states of Oklahoma, Arizona, and New Hampshire in which the law does not cover fatal accidents and liability is limited to $5,000 for each person killed. Most of the laws hold the general contractor liable if the sub-contractor does not provide Compensation Insurance. It is therefore essential that the general contractor request certificates from sub-contractors showing that they carry such insurance.

The rates shown are manual rates and are subject to modification by an experience charge or credit assigned to each individual risk that qualifies under the various experience rating plans.

The following states have monopolistic State Compensation Laws:

Washington	Oregon
North Dakota	West Virginia
Nevada	Wyoming
Ohio	

West Virginia is a semi-monopolistic State.

For rates and other information in these States, write to the State Insurance Commissioner.

Employer's Liability Insurance.—This covers the employer's legal liability for damage on account of personal injuries to their employees. In the seven states that have no compensation laws and which are known as Employer's Liability States, each accident is a case for

individual adjustment and frequently for court settlement. The differences in the rates shown are due to experience and the nature of the laws of the states relating to employer and employee.

Public Liability Insurance.—This covers the employer's legal liability for damages arising from injuries to persons not in their employ but which was caused by the operation of their own employees. The rates for this form of insurance are the same in all states expect Pennsylvania and Delaware.

Contractor's Protective Liability Insurance.—This provides indemnity for contractors against claims arising out of accidents to persons not in their employ, on account of construction operations performed by sub-contractors. The rates for this form of insurance per $100 of the total cost of the work sublet for each specific contract, including the cost of all labor, materials and equipment, are as follows:

Up to and including $500,000 of total cost...	12½ cts.
In excess of $500,000, up to and including $1,000,000.....	10 cts.
In excess of $1,000,000.....	7½ cts.

Owners' Protective Liability Insurance.—This provides indemnity for owners against claims arising out of accidents to persons not in their employ, on account of construction operations performed by independent contractors. The rates for this form of insurance per each $100 of the total cost of the entire job, for each specific contract, including the cost of all labor materials and equipment, are as follows:

Up to and including $500,000 of total cost....	10 cts.
In excess of $500,000, up to and including $1,000,000.....	7½ cts.
In excess of $1,000,000.....	5 cts.

Cost Plus Percentage Contracts.—If an owner employs a contractor or if a contractor employs a sub-contractor on a cost plus percentage or cost plus a fixed fee basis, for insurance purposes the relation will be those of principal and agent. It is therefore essential that both parties or all parties involved in such contracts be covered jointly.

Property Damage Insurance.—This covers contractors' or owners' legal ability for damage to the property of others caused by their operations. Submit risk for rating.

Paymaster Robbery Insurance.—This covers all loss or damage to payroll money and checks occasioned by robbery or attempt thereat outside and inside of premises, including 10 per cent coverage on other money and securities outside of premises. Except for Cook and Lake Counties, Illinois, the rate is $7.50 per $1,000 for the custodian carrying the largest amount and $2.50 per $1,000 for each additional custodian. The rates are subject to reductions if guards or other protection is provided. If the total payroll is $50,000 automatic coverage can be provided up to 25 per cent additional and adjustable by audit. The rate for Cook and Lake Counties, Illinois, is $10 per $1,000 for the custodian carrying the highest amount and $3.33⅓ for each additional custodian.

Safe Burglary Insurance.—This can also be provided if funds have to be kept on the premises. Rates are according to type of safe, population of town or city, etc.

Limits.—Limits covering Public Liability, Employer's Liability and Contractor's and Owner's Protective Liability Insurance in addition to the cost of defending suits, are $5,000 for each accident in which one person is injured and, subject to this limit for one person, $10,000 for each accident in which two or more people are injured. The percentages for increased limits are as follows;

$10 per 20,000 — 19 per cent	$10 per 40,000 — 32 per cent
20 per 50,000 — 37 per cent	20 per 100,000 — 42 per cent

It is important to note if contracts and specifications include clauses relating to assumed or contractual liability.

Fire Insurance.—If the contractor is to provide this form of insurance while in course of construction, it is important that the policy include all materials. The rates covering this form of insurance vary according to type of building, etc.

Tornado Insurance.—This form of insurance is carried by some contractors in parts where the hazard exists. The rates are low and vary according to the season and locality.

Contractor's Bonds.—The premium for a contractor's bond to guarantee the faithful performance of contract is 1½ per cent of the gross amount of contract. This carries the contract for two years, and there is no refund if the contract is finished in a shorter time. The renewal rate for the third and subsequent years is ¾ per cent per annum of the entire original contract. This applies to Federal, State, and private work, but not to Municipal work.

Workmen's Compensation Insurance Premium per $100 of Payroll

Trade	Alabama	Arizona	California	Colorado	Connecticut
1. Wrecking buildings	$7.47	$ 9.31	$16.33	$6.75	$ 8.78
2. Pile driving, building foundations	4.39	5.30	9.68	4.35	4.98
3. Cellar excavation, no caisson or subaqueous work	2.03	2.43	4.82	2.00	2.34
4. Concrete foundations for buildings other than concrete	2.07	2.52	4.65	1.82	2.33
5. Masonry or concrete work; 3 stories, etc	2.11	2.58	4.57	1.84	2.35
6. Masonry, marble, stone, brick, tile, T. C	2.78	3.46	4.57	2.53	3.37
7. Concrete floors and pavements, not reinforced	1.16	1.41	2.66	1.12	1.28
8. Concrete work, reinforced buildings	3.43	4.18	5.27	3.10	4.06
9. Carpentry, construction	3.95	4.83	4.15	3.49	4.44
10. Carpentry, interior trim, cabinet work, builders' finish	.89	1.08	4.15	.76	1.26
11. Fireproofing, concrete and lathing	3.05	3.70	6.94	2.71	3.44
12. Structural iron and steel erection	9.10	11.42	18.73	8.27	10.80
13. Iron and steel balconies and fire escapes	9.10	11.42	18.73	8.27	10 80
14. Ornamental iron, brass, bronze, interior erection	2.20	2.67	5.04	1.99	2.59
15. Roofing—all kinds	4.40	5.48	7.39	3.98	5.16
16. Waterproofing, in or on structures	2.02	2.43	4.65	1.81	2.27
17. Plastering, plaster board and blocks	1.66	2.03	3.30	1.40	2.33
18. Sheet metal work	1.49	1.76	6.47	1.31	1.68
19. Plumbing, heating, gas fitting	.90	1.05	2.15	.83	1.37
20. Glazing, on the job	2.11	2.51	3.57	2.03	3.31
21. Electrical apparatus—installing and repair	1.76	2.15	2.77	1.59	2.07
22. Electrical equipment—installing and repair	.90	1.06	1.88	.85	1.40
23. Painting and decorating—interior	.88	1.09	1.22	.75	1.28
24. Painting and decorating—exterior	4.26	5.34	8.09	3.75	4.24
25. Watchmen, timekeepers and cleaners	1 46	1.83	3.13	1.36	1.86
26. Officers and superintendent—supervising	.71	.86	1.57	.66	.87
27. Carpentry—3 stories	1.65	2.06	4.15	1.47	1.47
28. Cellar excavating—3 stories, etc	1.28	1.56	2.94	1.30	1.47
29. Iron and steel erection—not structural	5.09	6.43	10.89	4.58	5.95

Note.—Items 5, 27 and 28 only apply to building of private residences, flats or apartments, with or without stores, one-story stores and stores with offices above, private garages and buildings, all not exceeding three stores and basement in height, including jobbing work connected therewith (no blasting).

Apply the higher rates for reinforced concrete buildings having self-bearing floors, mercantile or factory buildings, public garages, round houses and buildings such as school houses, churches, theatres, railroad stations, court houses, city halls and capital buildings having spans more than 20 ft. above the floor.

Blasting.—The rates shown include incidental blasting unless specifically excluded. Rates given here are as of September 15, 1923.

Workmen's Compensation Insurance Premium per $100 of Payroll (*Continued*)

Trade	Delaware	Georgia	Idaho	Illinois	Indiana
1. Wrecking buildings	$6.00	$7.25	$10.23	$10.40	$ 9.64
2. Pile driving, building foundations	3.10	4.24	6.01	7.01	6.52
3. Cellar excavation, no caisson or subaqueous work	1.05	1.96	2.81	3.26	3.02
4. Concrete foundations for buildings other than concrete	1.80	2.00	2.79	2.85	2.90
5. Masonry or concrete work; 3 stories, etc.	1.10	2.05	2.85	2.89	2.96
6. Masonry, marble, stone, brick, tile, T. C.	1.10	2.69	3.86	3.92	3.88
7. Concrete floors and pavements, not reinforced	1.80	1.12	1.55	1.77	1.71
8. Concrete work, reinforced buildings	1.80	3.31	4.76	4.11	4.82
9. Carpentry, construction	1.15	3.83	5.32	7.47	7.56
10. Carpentry, interior trim, cabinet work, builders' finish	1.15	.87	1.16	1.12	1.19
11. Fireproofing, concrete and lathing	1.80	2.95	4.14	4.22	4.28
12. Structural iron and steel erection	4.00	8.84	12.49	16.32	16.10
13. Iron and steel balconies and fire escapes	1.30	8.84	12.49	12.69	12.66
14. Ornamental iron, brass, bronze, interior erection	1.30	2.12	3.06	3.11	3.11
15. Roofing—all kinds	3.00	4.27	6.04	6.13	6.14
16. Waterproofing, in or on structures	3.00	1.95	2.74	2.80	2.85
17. Plastering, plaster board and blocks	.70	1.62	2.13	2.05	2.17
18. Sheet metal work	1.50	1.43	2.05	2.10	2.09
19. Plumbing, heating, gas fitting	.60	.86	1.24	1.21	1.21
20. Glazing, on the job	1.00	2.01	2.99	2.94	2.85
21. Electrical apparatus—installing and repair	1.35	1.70	2.43	2.48	2.47
22. Electrical equipment—installing and repair	.55	.86	1.26	1.23	1.20
23. Painting and decorating—interior	1.50	.86	1.17	1.12	1.18
24. Painting and decorating—exterior	1.50	4.17	5.65	5.75	5.88
25. Watchmen, timekeepers and cleaners	.....	1.41	2.08	2.10	2.04
26. Officers and superintendent—supervising	.30	.68	1.01	1.01	1.00
27. Carpentry—3 stories	1.15	1.61	2.22	2.07	2.29
28. Cellar excavating—3 stories, etc.	1.05	1.24	1.75	2.08	1.91
29. Iron and steel erection—not structural	4.00	4.97	6.92	7.05	7.07

Note.—Items 5, 27 and 28 only apply to building of private residences, flats or apartments, with or without stores, one-story stores and stores with offices above, private garages and buildings, all not exceeding three stores and basement in height, including jobbing work connected therewith (no blasting).

Apply the higher rates for reinforced concrete buildings having self-bearing floors, mercantile or factory buildings, public garages, round houses and buildings such as school houses, churches, theatres, railroad stations, court houses, city halls and capital buildings having spans more than 20 ft. above the floor.

Blasting.—The rates shown include incidental blasting unless specifically excluded. Rates given here are as of September 15, 1923.

Workmen's Compensation Insurance Premium per $100 of Payroll. (*Continued*)

Trade	Iowa	Kansas	Kentucky	Louisiana	Maine
1. Wrecking buildings	$ 8.50	$ 9.97	$12.28	$10.86	$13.81
2. Pile driving, building foundations	4.53	5.82	7.29	6.92	5.52
3. Cellar excavation, no caisson or subaqueous work	2.09	2.68	3.37	3.23	4.00
4. Concrete foundations for buildings other than concrete	2.21	2.75	3.40	3.05	3.48
5. Masonry or concrete work; 3 stories, etc	2.25	2.83	3.47	3.12	2.19
6. Masonry, marble, stone, brick, tile, T. C.	3.21	3.68	4.54	4.06	5.25
7. Concrete floors and pavements, not reinforced	1.16	1.54	1.92	1.80	1.52
8. Concrete work, reinforced buildings	3.84	4.52	5.65	5.05	5.25
9. Carpentry, construction	6.06	7.26	6.50	5.80	5.25
10. Carpentry, interior trim, cabinet work, builders' finish	.83	1.17	1.13	.99	.96
11. Fireproofing, concrete and lathing	3 28	4 06	5.02	4.51	4.58
12. Structural iron and steel erection	13 94	15.66	14.98	13.18	12.61
13. Iron and steel balconies and fire escapes	10.47	12.20	14.98	13.18	6.61
14. Ornamental iron, brass, bronze, interior erection	2 46	2.90	3.61	3.25	3.18
15. Roofing—all kinds	4.98	5.87	7.25	6.41	5.03
16. Waterproofing, in or on structures	2 14	2.67	3.32	3.02	2 53
17. Plastering, plaster board and blocks	1.57	2.15	2.07	1.80	2.09
18. Sheet metal work	1.57	1.93	2.47	2.25	1.80
19. Plumbing, heating, gas fitting	.90	1.13	1.19	1.05	1.17
20. Glazing, on the job	2.34	2.63	2.88	2.54	3.63
21. Electrical apparatus—installing and repair	1 96	2 33	2.90	2.61	2.19
22. Electrical equipment—installing and repair	.94	1.13	1.21	1.04	1.22
23. Painting and decorating—interior	.92	1.03	1.14	.98	1.52
24. Painting and decorating—exterior	4.64	5.77	7.03	6.19	3.81
25. Watchmen, timekeepers and cleaners	1.76	1.92	2.39	2.12	3.98
26. Officers and superintendent—supervising	.82	.92	1 15	1.05	1.92
27. Carpentry—3 stories	1.83	2.22	2.71	2.40	1.84
28. Cellar excavating—3 stories, etc	1.33	1.69	2.12	2.02	2.19
29. Iron and steel erection—not structural	5.82	6.87	8.36	7.35	8.01

Note.—Items 5, 27 and 28 only apply to building of private residences, flats or apartments, with or without stores, one-story stores and stores with offices above, private garages and buildings, all not exceeding three stores and basement in height, including jobbing work connected therewith (no blasting).

Apply the higher rates for reinforced concrete buildings having self-bearing floors, mercantile or factory buildings, public garages, round houses and buildings such as school houses, churches, theatres, railroad stations, court houses, city halls and capital buildings having spans more than 20 ft. above the floor.

Blasting.—The rates shown include incidental blasting unless specifically excluded. Rates given here are as of September 15, 1923.

WORKMEN'S COMPENSATION INSURANCE PREMIUM PER $100 OF PAYROLL.
(*Continued*)

Trade	Maryland	Massachusetts	Michigan	Minnesota	Montana
1. Wrecking buildings	$ 9.86	$12.00	$10.20	$13.42	$7.55
2. Pile driving, building foundations	5.82	4.50	6.35	8.88	4.23
3. Cellar excavation, no caisson or subaqueous work	2.68	2.50	2.97	4.08	1.96
4. Concrete foundations for buildings other than concrete	2.56	2.60	2.79	3.81	1 99
5. Masonry or concrete work, 3 stories, etc	2.60	3.30	2.84	3.46	2.03
6. Masonry, marble, stone, brick, tile, T. C	3.75	4.10	3.80	4.08	2.86
7. Concrete floors and pavements, not reinforced	1.51	1.35	1.62	2.32	1.09
8. Concrete work, reinforced buildings	4.39	3.60	4.72	6.23	3.42
9. Carpentry, construction	4.91	5.10	7.37	8.65	3.81
10. Carpentry, interior trim, cabinet work, builders' finish	1.01	1.00	1.01	1.39	.81
11. Fireproofing, concrete and lathing	3.76	3.90	4.14	5.65	2.94
12. Structural iron and steel erection	12.20	12.00	16.03	20.25	9.30
13. Iron and steel balconies and fire escapes	12.20	7.90	12.43	16.23	9.30
14. Ornamental iron, brass, bronze, interior erection	2.82	2.80	3.05	4.03	2 18
15. Roofing—all kinds	5.78	6.60	6.01	7.94	4.44
16. Waterproofing, in or on structures	2.47	2.60	2.73	3.78	1.92
17. Plastering, plaster board and blocks	1.94	1.90	1.87	2.60	1.50
18. Sheet metal work	1.76	1.90	2.04	2.80	1.40
19. Plumbing, heating, gas fitting	1.04	1.00	1.09	1.44	.84
20. Glazing, on the job	2.70	2.60	2.68	3.30	2.11
21. Electrical apparatus—installing and repair	2.25	2.00	2.43	3.20	1.74
22. Electrical equipment—installing and repair	1.09	.95	1.11	1.41	.87
23. Painting and decorating—interior	1.23	1.05	1.04	1.38	.84
24. Painting and decorating—exterior	4.93	5.70	5.71	7.81	4.16
25. Watchmen, timekeepers and cleaners	2.08	2.00	2.02	2.52	1.57
26. Officers and superintendent—supervising	.92	.93	.96	1.25	.73
27. Carpentry—3 stories	1.67	1.60	2.72	3.00	1.64
28. Cellar excavating—3 stories, etc	1.75	1.70	1.87	2.57	1.26
29. Iron and steel erection—not structural	6.81	6.70	6.92	9.13	5.18

NOTE.—Items 5, 27 and 28 only apply to building of private residences, flats or apartments, with or without stores, one-story stores and stores with offices above, private garages and buildings, all not exceeding three stores and basement in height, including jobbing work connected therewith (no blasting).

Apply the higher rates for reinforced concrete buildings having self-bearing floors, mercantile or factory buildings, public garages, round houses and buildings such as school houses, churches, theatres, railroad stations, court houses, city halls and capital buildings having spans more than 20 ft. above the floor.

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Workmen's Compensation Insurance Premium per $100 of Payroll. (*Continued*)

Trade	Nebraska	New Hampshire	New Jersey	New Mexico	New York
1. Wrecking buildings	$12.35	$7.49	$6.95	$7.21	$19.60
2. Pile driving building foundations	7.15	4.25	3.50	4 17	9.34
3. Cellar excavation, no caisson or subaqueous work	3.31	1.96	1.71	1.93	4.28
4. Concrete foundations for buildings other than concrete	3.36	2.02	1.88	1.97	4.45
5. Masonry or concrete work; 3 stories, etc	3.43	2.06	1.57	2.01	4.55
6. Masonry, marble, stone, brick, tile, T. C	4.62	2.80	2.32	2.69	7.19
7. Concrete floors and pavements, not reinforced	1.87	1.12	1.15	1.10	2.46
8. Concrete work, reinforced buildings	5.65	3.38	2.65	3.29	6.72
9. Carpentry, construction	8.91	3.86	4.15	3.76	11.56
10. Carpentry, interior trim, cabinet work, builders' finish	1.42	.86	1.22	.84	2.51
11. Fireproofing, concrete and lathing	4 96	2.97	2.80	2 91	6.54
12. Structural iron and steel erection	15.11	9.20	8.70	8 83	21.66
13. Iron and steel balconies and fire escapes	15 11	9 20	8.70	8 83	21.66
14. Ornamental iron, brass, bronze, interior erection	3 62	2.16	2.01	2 11	4 76
15. Roofing—all kinds	7.28	4.41	4.09	4.25	9.90
16. Waterproofing, in or on structures	3.27	1.95	1.86	1.91	3.89
17. Plastering, plaster board and blocks	2 64	1.60	1.22	1.56	4.68
18. Sheet metal work	2.40	1.41	1.73	1.40	3.05
19. Plumbing, heating, gas fitting	1.44	.85	.91	.84	2.37
20. Glazing, on the job	3.47	2.05	2.24	2.01	4.49
21. Electrical apparatus—installing and repair	2.89	1.73	2.14	1.69	3.00
22. Electrical equipment—installing and repair	1.46	.86	.90	.85	1.87
23. Painting and decorating—interior	1.43	.92	2.44	.84	2.49
24. Painting and decorating—exterior	6.96	3.86	2.44	4.09	8.97
25. Watchmen, timekeepers and cleaners	2.46	1.49	1.33	1.43	3.09
26. Officers and superintendent—supervising	1.18	.70	.64	.69	1 56
27. Carpentry—3 stories	2.71	1.35	1.22	1.59	2.90
28. Cellar excavating—3 stories, etc	2.09	1.25	1.71	1.22	2.77
29. Iron and steel erection—not structural	8.44	5.16	4.74	4.94	10.28

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WORKMEN'S COMPENSATION INSURANCE PREMIUM PER $100 OF PAYROLL.
(*Continued*)

Trade	Oklahoma	Pennsylvania	Rhode Island	South Dakota	Tennessee
1. Wrecking buildings	$ 8.40	$6.00	$ 8.54	$ 9.94	$8.01
2. Pile driving building foundations	5.09	3.10	4.54	5.96	4.60
3. Cellar excavation, no caisson or subaqueous work	2.36	1.05	2.14	2.74	2.13
4. Concrete foundations for buildings other than concrete	2.38	1.80	2.22	2.82	2.17
5. Masonry or concrete work; 3 stories, etc	2.42	1.10	2.25	2.88	2.22
6. Masonry, marble, stone, brick, tile, T. C	3.11	1.10	3.28	3.64	2.99
7. Concrete floors and pavements, not reinforced	1.34	1.80	1.17	1.60	1.21
8. Concrete work, reinforced buildings	3.93	1.80	3.86	4.56	3.64
9. Carpentry, construction	4.53	1.15	4.24	7.27	4.15
10. Carpentry, interior trim, cabinet work, builders' finish	1.04	1.15	.87	1.26	.92
11. Fireproofing, concrete and lathing	3.52	1.80	3.27	4.15	3.20
12. Structural iron and steel erection	10.17	4.00	10.58	15.09	9.81
13. Iron and steel balconies and fire escapes	10.17	1.30	10.58	12.05	9.81
14. Ornamental iron, brass, bronze, interior erection	2.54	1.30	2.48	2.93	2.33
15. Roofing—all kinds	4.96	3.00	5.04	5.87	4.72
16. Waterproofing, in or on structures	2.35	3.00	2.15	2.76	2.11
17. Plastering, plaster board and blocks	1.92	.70	1.63	2.36	1.72
18. Sheet metal work	1.76	1.50	1.56	2.04	1.54
19. Plumbing, heating, gas fitting	1.06	.60	.92	1.23	.93
20. Glazing, on the job	2.44	1.00	2.39	2.75	2.22
21. Electrical apparatus—installing and repair	2.02	1.35	1.97	2.35	1.98
22. Electrical equipment—installing and repair	1.06	.55	.95	1.21	.94
23. Painting and decorating—interior	1.01	1.50	1.03	1.22	.93
24. Painting and decorating—exterior	4.80	1.50	4.18	5.84	4.53
25. Watchmen, timekeepers and cleaners	1.62	.....	1.82	1.85	1.60
26. Officers and superintendent—supervising	.81	.30	.84	.91	.76
27. Carpentry—3 stories	1.86	1.15	1.42	2.24	1.76
28. Cellar excavating—3 stories, etc	1.47	1.05	1.36	1.72	1.35
29. Iron and steel erection—not structural	5.67	4.00	5.87	6.80	5.49

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Workmen's Compensation Insurance Premium per $100 of Payroll. (*Continued*)

Trade	Texas	Utah	Vermont	Virginia	Wisconsin
1. Wrecking buildings	$10.04	$10.99	$7.66	$6.87	$11.99
2. Pile driving building foundations	5 92	6.41	4.61	4 01	7.25
3. Cellar excavation, no caisson or subaqueous work	2.75	2.98	2.14	1 87	2.49
4. Concrete foundations for buildings other than concrete	2.61	3.00	2.16	1.88	3.58
5. Masonry or concrete work; 3 stories, etc	2.65	3.05	2.21	1.92	2.51
6. Masonry, marble, stone, brick, tile, T. C	3.82	4.13	2.83	2.58	3.90
7. Concrete floors and pavements, not reinforced	1.52	1.66	1.22	1.05	1.39
8. Concrete work, reinforced buildings	4.53	5.07	3.55	3.16	3.58
9. Carpentry, construction	5.00	5.72	4.12	3.59	3.16
10. Carpentry, interior trim, cabinet work, builders' finish	1.22	1.26	.95	.80	3.16
11. Fireproofing, concrete and lathing	3.86	4.43	3.19	2.78	4.94
12. Structural iron and steel erection	12 40	13 44	9.28	8.39	18.51
13. Iron and steel balconies and fire escapes	12 40	13.44	9.28	8.39	14.53
14. Ornamental iron, brass, bronze, interior erection	2.84	3 25	2 29	2.03	3.60
15. Roofing—all kinds	5.90	6.48	4.52	4.05	7.06
16. Waterproofing, in or on structures	2 51	2 93	2.13	1.84	3.30
17. Plastering, plaster board and blocks	2.27	2.32	1.76	1.48	2.26
18. Sheet metal work	2.78	2.17	1.58	1.36	4.76
19. Plumbing, heating, gas fitting	1.28	1.31	.96	.82	1.25
20. Glazing, on the job	3.22	3.15	2.19	1.96	3.06
21. Electrical apparatus—installing and repair	2 29	2.59	1.83	1.62	2.23
22. Electrical equipment—installing and repair	1.34	1 33	.95	.83	1.54
23. Painting and decorating—interior	1.28	1.26	.92	.80	1.25
24. Painting and decorating—exterior	5.50	6.13	3.97	3.86	6.72
25. Watchmen, timekeepers and cleaners	2.11	2.21	1.46	1.37	2.35
26. Officers and superintendent—supervising	.98	1.07	.73	.66	1.15
27. Carpentry—3 stories	2.15	2.40	1.46	1.51	3.16
28. Cellar excavating—3 stories, etc	1.77	1.87	1.33	1.17	2.09
29. Iron and steel erection—not structural	6.91	7.48	5.20	4.68	8.24

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Trade	Employer's liability							Public liability	
	Arkansas	District of Columbia	Florida	Mississippi	Missouri	North Carolina	South Carolina	5/10 Limit all states excepting Penn. and Del.	5/10 Limit Penn. and Del.
1. Wrecking buildings	$10.05	$3.80	$6.20	$11.10	$12.80	$9.00	$6.90	$2.70	$2.70
2. Pile driving building foundations	3.02	1.14	1.86	3.33	3.84	2.70	2.07	.85	.15
3. Cellar excavation, no caisson or subaqueous work	2.65	1.00	1.64	2.93	3.38	2.38	1.82	.85	.73
4. Concrete foundations for buildings other than concrete	2.05	.78	1.26	2.26	3.57	1.84	1.41	.45	.41
5. Masonry or concrete work; 3 stories, etc	1.01	.38	.62	1.11	1.36	.90	.69	.45	.45
6. Masonry, marble, stone, brick, tile, T. C	2.05	.78	1.26	2.26	3.57	1.84	1.41	.45	.45
7. Concrete floors and pavements, not reinforced	.92	.35	.57	1.02	1.18	.83	.63	.45	.41
8. Concrete work, reinforced buildings	3.08	1.16	1.90	3.40	4.14	2.75	2.11	.45	.41
9. Carpentry, construction	1.61	.61	.99	1.78	6.11	1.44	1.32	.25	.23
10. Carpentry, interior trim, cabinet work, builders' finish	.76	.29	.47	.84	.97	.68	.52	.15	.23
11. Fireproofing, concrete and lathing	2.05	.78	1.26	2.26	3.57	1.84	1.41	.45	.41
12. Structural iron and steel erection	10.05	3.80	6.20	11.10	12.80	9.00	6.90	1.15	1.15
13. Iron and steel balconies and fire escapes	10.05	3.80	6.20	11.10	12.80	9.00	6.90	1.15	.45
14. Ornamental iron, brass, bronze, interior erection	2.89	1.09	1.79	3.20	3.69	2.59	1.99	.25	.45
15. Roofing—all kinds	3.02	1.14	1.86	3.33	3.84	2.70	2.07	.85	.85
16. Waterproofing, in or on structures	1.51	.57	.93	1.67	1.92	1.35	1.04	.15	.85
17. Plastering, plaster board and blocks	1.11	.42	.68	1.22	1.41	.99	.76	.15	.15
18. Sheet metal work	2.89	1.09	1.79	3.20	3.69	2.59	1.99	.30	.30
19. Plumbing, heating, gas fitting	1.79	.68	1.10	1.98	3.19	1.60	1.23	.15	.15
20. Glazing, on the job	1.55	.59	.95	1.71	1.97	1.39	1.06	.15	.02
21. Electrical apparatus—installing and repair	1.89	.71	1.17	2.09	2.41	1.69	1.30	.25	.25
22. Electrical equipment—installing and repair	.84	.32	.52	.93	1.08	.76	.58	.25	.25
23. Painting and decorating—interior	1.11	.42	.68	1.22	1.50	.99	.76	.15	.30
24. Painting and decorating—exterior	3.90	1.47	2.41	4.31	4.97	3.49	2.68	.95	.30
25. Watchmen, timekeepers and cleaners	1.53	.58	.94	1.69	1.95	1.37	1.05	.45	
26. Officers and superintendent—supervising	.68	.26	.42	.75	.87	.61	.47	.45	.45
27. Carpentry—3 stories	.84	.32	.52	.93	1.08	.76	.58	.25	.23
28. Cellar excavating—3 stories, etc	1.71	.65	1.05	1.89	2.18	1.53	1.17	.15	.73
29. Iron and steel erection—not structural	5.69	2.15	3.51	6.28	7.24	5.09	3.91	1.15	1.15

Maintenance Bonds.—The premium on maintenance bonds is ¾ per cent per annum. This is to cover material already supplied and installed in the job, and on which no bond has previously been given. Under the terms of the contract where the work performed is to be maintained or guaranteed for a special period of time, the bond given is known as the Maintenance Bond, and if it covers the entire work performed under the construction contract, the rate per annum will be ¼ of the original premium charged for the Construction Bond.

"Cost Plus" Contract Bonds.—"Cost Plus" contracts, where no price limit is fixed either as maximum offset price or otherwise, are rated at 1 per cent of the cost to the owner with a maximum of 5 per cent on the penalty of the bond. Five per cent of the bond penalty may be charged as an advance premium subject to adjustment when contract is completed and cost is known. (Not applicable to "cost plus" contract with the U. S. Government. These are separately rated.)

On construction contracts which are subject to a fixed minimum of 1½ per cent of the contract price, bonds may be taken out at the option of the contractor for an amount less than 20 per cent of the contract price. In this case the rate of premium will be 7½ per cent per annum of the penalty of the bond.

For construction contracts not subject to a fixed minimum of 1½ per cent of the contract price, a bond may be taken out at the option of the contractor for an amount less than 10 per cent of the contract price. The premium in this case being 7½ per cent per annum of the penalty of the bond.

General Office Expense.—This expense is variable depending upon the size of the office force which the contractor keeps and the amount of work performed during the year. This can best be determined by any given concern from its own records, providing it has been in business long enough to have records showing the average cost of keeping up its office and the approximate amount of work performed per year. This expense, however, generally ranges between 1 and 5 per cent of the work done. Perhaps 2 or 3 per cent would be a fair average.

Traveling Expense.—This is a variable item, and if the contractor is doing only a local business, may be negligible. If he is doing business out of town and taking with him to the various jobs a superintendent and the various foremen for masonry, carpentry, labor gangs,

etc., these items may be of considerable importance. They cannot be given as a percentage however, but should be figured for each individual job.

Use of Tools and Equipment.—This is an item that is frequently overlooked especially where the contractor has a plant of his own sufficiently large to carry out the work in hand. As tools are constantly wearing out and in some cases becoming obsolete, due to the invention of newer and better tools, and as the cost of upkeep and of moving them from place to place is considerable, a charge should always be made. Some contractors have made this charge as a percentage of labor only, and in certain cases have assumed 2 per cent, while other contractors have used a smaller per cent for the entire job. A far better way is to estimate the amount of machinery and tools that will be required at the job, including such items as steam shovels, concrete mixers, hoisting engines, wheelbarrows, etc., and to charge for the cost of transportation and rental. (See table on Rental of Equipment on page 19.)

Field Supervision.—This should not be figured as a percentage of the job, but an estimate should always be made of the time required for completion and the number and grade of men necessary, such as general superintendent, foreman for different gangs, material clerk, time keepers, watchmen, water boy, etc., and their salaries computed.

Job Office, Cement Sheds, etc.—These items should be roughed up by the estimator and the approximate price put in for what will actually be required for the job under construction, taking into account whether it will be possible or not to bring any or all of them from previous jobs. In this connection it is well to consider such items as scaffold plank, horses, runway plank, etc. To most contractors doing local work there is only the cost of moving from one job to another. On isolated jobs frequently considerable material has to be purchased which at the completion of the job is worth little or nothing.

Photographs.—Where no photographs are called for in the specification, the contractor may or may not care to include such an item, but in many cases it is specified that a number of photographs shall be taken at fixed intervals by a professional photographer and in such cases the item should be included.

Repairing Streets and Pavements.—This item is intended to cover the cost of repairing sidewalks, street pavements, etc., which are damaged during the construction of the building.

Building and Other Permits.—A charge is usually made in the larger cities for building and other permits. Where the sidewalk vault extends out into the street, the charge frequently becomes a a very important item. The item of permits can be figured only by knowing the laws under which the building is to be constructed.

Removing Rubbish and Cleaning Up.—The cost of removing rubbish and cleaning up varies decidedly with the location of the building. If it is located in the country or near some free dump, the cost may not be more than half as much as if it is located in the business district of some of our larger cities. However, in figuring the overhead, this item should always be taken care of.

Cutting for Other Trades.—Many specifications require that the mason shall do all necessary cutting for plumbing and heating pipes, etc. This frequently applies also to the carpenter, marble setter and others who are to do all necessary cutting in connection with their own work. This is not as important as some of the other items, but frequently adds considerable expense, and a proper allowance should be made.

Average Overhead Costs.—In order to get an average overhead for some of the above items, I secured from fourteen general contractors, whose headquarters were located in seven different states, data from their past experience. The average was as follows:

	Per Cent of Total Work Done
Tools and equipment	1.77
Field supervision	4.11
General office expense, salaries, rents, etc	4.51
Field office, cement sheds, traveling expense, photographs, etc	1.15
Total for above	11.54

To the above should be added:

	Per Cent
Public liability and indemnity insurance about	2.00
Fire insurance	1.00
Contractor's bonds (when required)	1.50
Total for above	4.50

Profit.—After all of these overhead costs have been added there still remains the contractor's profit. It is usually conceded that a contractor should make 10 per cent profit on the work he does. This, however, is sometimes shaded on large work and it is frequently necessary to figure more than 10 per cent on small jobs, as it is almost impossible to include all of the overhead on such work.

Getting the Contract.—To be a successful contractor three things are necessary: first, contracts must be taken; second, the work must be performed in such a manner as in general to satisfy the architect and owner; and third, a profit must be made. If the contractor continually fails in any one of the above items, he cannot hope to succeed. Technical skill is necessary in getting profitable contracts, and in order that the necessary knowledge may be available, and constantly be brought to a higher degree of accuracy, every contractor should keep careful records of the cost of all important jobs performed. These records should be kept in detail, and compared with the original estimates item by item so as to eliminate errors in future bidding.

Field Supervision.—It is never an economy to try to get along without good field supervision. There should be a sufficient field organization to handle the work economically and efficiently, as well as to keep a record of costs, to look after the multitude of details, and to see that the materials and supplies are ordered in time to be delivered at the job when needed without causing delays, as delays are always costly.

Schedule of Construction.—It is advisable on a job of any magnitude to make out a schedule in advance, showing in detail when each part of the work is to begin, when it is to reach certain definite stages and when it should be completed. This schedule should show when each kind of material is needed at the job, the quantities required, the order of delivery and the time of completion. Every material man should be informed well in advance when he should commence to furnish material, how fast the material will be required, and when he is to complete delivery. It is a good thing to consult the field superintendent in preparing the construction schedule as his knowledge will be of assistance in this work. It will also make him more responsible in carrying out the requirements in order to complete the job at the proposed completion date.

CONTRACTOR'S EQUIPMENT

Every general contractor is obliged either to own or to rent considerable equipment. In either case he needs to know not only the original cost, but also the amount he should allow for repairs, storage, insurance, etc. For this purpose, the Associated General Contractors of America have prepared the following table which gives the required information:

Equipment Rental Schedule

The schedule of percentage values given below represents for, individual construction machines, the annual expense of equipment ownership, expressed in terms of original capital investment, based on the experience of a large number of representative construction firms. These percentages, which include no allowance for profit, apply to equipment operating under the wear and tear of ordinary job conditions. Exceptionally favorable or unfavorable conditions would warrant changing the values as individual judgment indicates. The original capital investment of a machine is the price f.o.b. constructor's unloading point.

Items of equipment	Economical life, years	Annual equipment expense							
		Depreciation (salvage value 25 per cent)	Interest at 6½ per cent	Shop repairs, per cent	Field repairs, per cent	Storage incidentals per cent	Insurance, per cent	Taxes, per cent	Total per cent
Auto crane	5	15	4	6	5	3½	1	1	35½
Auto truck	3	25	4	20	20	3½	1	1	74½
Auto trailer	5	15	4	6	5	3½	1	1	35½
Backfiller, power	4	18¾	4	6	7	3½	1	1	41¼
Ballast spreader	8	9½	4	6	4	3½	1	1	29
Boiler, upright	8	9½	4	20	5	3½	1	1	44
Boiler, locomotive	8	9½	4	15	5	3½	1	1	39
Bucket, clam-shell	4	18¾	4	15	6	3½	1	1	49¼
Bucket, orange-peel	4	18¾	4	25	6	3½	1	1	59¼
Bucket drag-line	4	18¾	4	12	3	3½	1	1	43¼
Cars, steel dump	6	12½	4	8	4	3½	1	1	34
Cars, wood dump	5	15	4	7	3	3½	1	1	34½
Cars, flat	8	9½	4	4	3	3½	1	1	26
Cars, hopper	5	15	4	8	3	3½	1	1	35½
Compressor, steam	7	10¾	4	6	3	3½	1	1	29¼
Compressor, gasoline	4	18¾	4	6	7	3½	1	1	41¼
Compressor, electric	6	12½	4	3	3	3½	1	1	28
Concrete chutes	2	37½	4	15	15	3½	1	1	77
Conveyor, belt	2	37½	4	7	6	3½	1	1	60
Conveyor, bucket	2	37½	4	10	6	3½	1	1	63
Crusher, rock	6	12½	4	5	3	3½	1	1	30
Derrick, wood	5	15	4	4	4	3½	1	1	32½
Derrick, steel	10	7½	4	4	3	3½	1	1	24
Dragline, steam	6	12½	4	9	8	3½	1	1	39

Items of equipment	Economical life, years	Annual equipment expense							
		Depreciation (salvage value 25 per cent)	Interest at 6½, per cent	Shop repairs, per cent	Field repairs, per cent	Storage incidentals, per cent	Insurance, per cent	Taxes, per cent	Total, per cent
Dragline, gasoline	4	18¾	4	10	10	3½	1	1	48¼
Dragline, electric	8	9½	4	7	7	3½	1	1	33
Drill, tunnel carriage	5	15	4	8	8	3½	1	1	40½
Drill, traction well	6	12½	4	7	10	3½	1	1	39
Drill, tripod	4	18¾	4	7	10	3½	1	1	45¼
Drill, jack hammer	4	18¾	4	7	6	3½	1	1	41¼
Engine, gas	6	12½	4	8	8	3½	1	1	38
Engine, steam	10	7½	4	5	5	3½	1	1	27
Excavator, cableway	6	12½	4	4	12	3½	1	1	38
Excaaator, Keystone	5	15	4	8	4	3½	1	1	36½
Excavator, trench	5	15	4	8	6	3½	1	1	38½
Forms, steel concrete	2	37½	4	20	20	3½	1	1	87
Graders, common road	4	18¾	4	12	6	3½	1	1	46¼
Graders, elevating	4	18¾	4	15	7	3½	1	1	50¼
Hoist, steam	10	7½	4	6	4	3½	1	1	27
Hoist, gasoline	6	12½	4	7	8	3½	1	1	37
Hoist, electric	8	9½	4	5	3	3½	1	1	27
Locomotive, Indus. steam	9	8½	4	6	4	3½	1	1	28
Locomotive, Indus. gas	4	18¾	4	13	10	3½	1	1	51¼
Locomotive, Indus. battery	4	18¾	4	15	4	3½	1	1	47¼
Locomotive, standard gauge	10	7½	4	6	4	3½	1	1	27
Locomotive crane, steam	8	9½	4	7	8	3½	1	1	34
Locomotive crane, elect	8	9½	4	6	4	3½	1	1	29
Mixer, steam	5	15	4	12	4	3½	1	1	40½
Mixer, gasoline	4	18¾	4	13	8	3½	1	1	49¼
Mixer, electric	6	12½	4	12	4	3½	1	1	38
Mixer, paving steam	5	15	4	13	4	3½	1	1	41½
Mixer, paving gas	3	25	4	16	9	3½	1	1	59½
Motors	6	12½	4	6	4	3½	1	1	32
Pile driver, steam	8	9½	4	7	5	3½	1	1	31
Pile driver, track	10	7½	4	5	3	3½	1	1	25
Pile hammer, steam	7	10¾	4	7	3	3½	1	1	30¼
Pipe, galvanized	3	25	4	5	6	3½	1	1	45½
Plows	3	25	4	15	10	3½	1	1	59½
Pneumatic concrete mach	4	18¾	4	20	8	3½	1	1	56¼
Pump, centrifugal	8	9½	4	6	4	3½	1	1	29
Pump, piston	6	12½	4	7	5	3½	1	1	34
Pump, impulse	8	9½	4	2	4	3½	1	1	25
Rails	8	9½	4	5	3	3½	1	1	27
Riveter, air	5	15	4	8	4	3½	1	1	36½
Rock channeler	6	12½	4	7	8	3½	1	1	37
Roller, steam road	10	7½	4	5	3	3½	1	1	25
Saw rigs	4	18¾	4	10	15	3½	1	1	53¼
Scraper, wheel	3	25	4	8	4	3½	1	1	46½
Scraper, slip	1	75	4	25	10	3½	1	1	119½
Scraper, fresno	2	37½	4	25	15	3½	1	1	87
Shovel, steam	6	12½	4	7	6	3½	1	1	35
Shovel, gasoline	4	18¾	4	9	7	3½	1	1	44¼
Shovel, electric	7	10¾	4	6	5	3½	1	1	31¼
Switches, fabricated	3	25	4	3	3	3½	1	1	40½
Tower, steel hoist	7	10¾	4	3	4	3½	1	1	27¼
Tractor, wheel gas	6	12½	4	9	5	3½	1	1	36
Tractor, caterpillar	5	15	4	15	10	3½	1	1	49½
Wagons, dump	4	18¾	4	17	3	3½	1	1	48¼
Wagons, hauling	4	18¾	4	12	3	3½	1	1	43¼
Wagon loaders, power	5	15	4	10	6	3½	1	1	40½

Seven items of equipment expense constitute the total rental charge and require consideration in estimating a lump sum contract or in determining fixed rate rentals.

They are (1) Depreciation, (2) Interest, (3) Shop Repairs, (4) Field Repairs, (5) Storage and Incidentals, (6) Insurance, (7) Taxes. Some of these items, especially depreciation and repairs, vary for different machines, and it is to establish average values for the most important articles of equipment that the schedule above has been drawn up.

How to Determine a Typical Rental Charge.—As a basis for comparing different machines, it is assumed that their economical life is over when the depreciation has reached 75 per cent, or, in other words, when the salvage value is reduced to 25 per cent. Upon this basis the annual rental charge for a machine having a life of six years is made up as follows:

	Per Cent
1. Average depreciation	12½
2. Equivalent annual interest at 6½ per cent	4
3. Shop repairs	6
4. Field repairs	4
5. Storage and incidentals	3½
6. Insurance	1
7. Taxes	1
Total annual expense	32

But the total annual expense is charged off during the usual working time in each year. Thus, where machines are used only eight months out of twelve, the monthly charge is one-eighth of 32 per cent, or 4 per cent per month. Likewise, where they are ordinarily utilized but 100 days in the year, the daily charge is one one-hundredth of 32 per cent, or 0.32 per cent per day.

Interest on Investment.—Interest at the prevailing rate is charged each year on either the depreciated value of equipment or on the average value throughout its economical life. The average value equals the sum of initial value and the salvage value, divided by two. When the salvage value is 25 per cent, the average value = (100 per cent + 25 per cent) ÷ 2 = 62½ per cent of the initial value. The prevailing interest rate is applied to this amount, giving the equivalent annual interest. Thus the equivalent annual interest is 62½

per cent × 6½ per cent (prevailing rate) = 4 per cent of the initial value.

Three Types of Charges.—Owners of equipment find occasion to establish rental rates as follows:

1. For a lump sum or unit price estimate.
2. To owners on cost-plus work.
3. To others than client owners.

In these instances charges are made as follows:

1. The rental charge or equipment expense for lump sum work includes all the items mentioned above.

2. The fixed rate to owners on cost-plus work will include all but field repairs, if this item is paid as a cost of the work. To the amount thus determined may be added a service charge depending upon the policy of the contractor, *i.e.*, whether the service of equipment is included in the profit fee or carried in the rental charge.

3. The charge to persons other than client owners includes all of the items of expense and an additional amount for profit or payment for the machine's earning power.

A further consideration in each of these cases is the rate for double shift work where the cost of depreciation and repairs may be doubled, or nearly so.

Individual Judgment Needed.—In using percentages such as those given in the rental schedule above, there is danger unless the conditions under which the equipment is to work are carefully investigated.

To illustrate: If the values here given for a standard-gage shovel outfit were applied to such an outfit engaged constantly in excavating hard rock, the probability is that the charges allowed would not cover the expense. Frequent dobey shots and the dropping of heavy boulders into cars entail a higher rate of depreciation and repairs than is given in the schedule. On the other hand, if this shovel outfit were steadily engaged in digging sandy loam, the values given in the table would probably cause the equipment charge to contain an element of profit.

Such a rental schedule sums up the experience of typical firms, and its value to others depends upon the individual judgment used in interpreting it in the light of the circumstances surrounding any particular job.

In addition to the above data the Association has prepared an equipment rental agreement, copies of which can be obtained by

addressing the Associated General Contractors of America, Munsey Building, Washington, D. C.

CHECKING LIST

General Conditions

Public Liability and Indemnity Insurance
Fire Insurance
Bond
Vault Permit
Water, Street and Building Permit,
Surveys
Removing Rubbish
Cleaning Floors and Windows
Temporary Heating
Temporary Fence
Temporary Lighting
Temporary Office
Temporary Sheds
Temporary W. C.
Temporary Telephone
Temporary Sidewalk and Overhead Bridges
Traveling Expense
Commissions
Guarantee
Tests
Damage to Adjoining Property
Photographs
Repairing Streets
Drawings
Tools
Administration

Masonry

Wrecking
Earth Excavation
Rock Excavation
Test Borings
Test Pits
Piling and Wood Grillage
Sheet Piling and Bracing
Shoring and Underpinning
Bridges, Fences, etc.
Caisson Work
Pumping and Bailing
Dimension Stone Caps
Rubble Masonry
Boiler Setting
Machine Foundations
Drain Pipe, etc.
Concrete Foundations
Concrete Walls
Hollow Brick
Fire Brick
Paving Brick
Common Brick
Flue Lining
Furring Brick
Face Brick
Radius Brick
Enameled Brick
Moulded Brick
Tile Coping
Setting Stone
Anchors and Clamps
Shutter Eyes
Cutting for other Trades
Cleaning Down and Repointing
Setting Terra Cotta
Finished Cement Floors
Basement Floor
Cement Sidewalk
Coal Chute
Cement Curb and Sills

Cut Granite, Limestone, Marble and Blue Stone

Front Work
Steps and Cheeks
Sidewalk Curb
Area Coping
Templates
Basin and Trench Covers
Stairs
Pit Openings
Separate Cornice and Sill Courses
Separate Ornaments
Main Cornice
Sills and Lintels
Parapet Copings
Machinery Bed Plates
Modeling and Carving
Setting
Water Table
Chimney Cap

Fireproofing

Floor Arches, different thicknesses
Partitions, different thicknesses
Outside Wall Furring
Book Tile
Column Covering Round
Column Covering Square
Girder Covering
Conduit Covering
Ceiling Tile
Cinder Concrete
Concrete under tile, etc.
Concrete, reinforced

Ornamental Iron Work

Interior Main Stairs
Interior Service Stairs
Outside Basement Stairs
Winding Stairs
Elevator Enclosures
Elevator Pans
Elevator Overhead Screens
Area Railing
Balconies
Marquise
Candelabra
Window Guards
Grilles
Radiator Grilles
Store Fronts
Conservatories
Window Fronts
Glass Domes
Mullions
Ornamental Columns
Ornamental Entrance Doors
Gates
Fences
Rolling Shutters
Iron Doors
Vault Doors
Patent Lights
Prism Lights
Coal Hole Covers
Coal Conveyors
Coal Chutes
Ash Lifts
Wheel Guards
Sidewalk Doors and Vents
Ladders
Fire Escapes
Fire Shutters
Solid Bronze Work
Electro Plating
Bower Barff Finish
Trunk Chute
Flag Pole
Trench Cover
Interior Office Fittings

Rough Carpentry

Sleepers
Under Flooring
Roof Sheathing
Finished Flooring
Building Paper
Pipe Pockets
Parquet Flooring
Temporary Stairs
Centers and Lintels
Temporary Enclosures
Wood Furring
Gutter Lining
Cornice and Balustrade Lining
Closets
Shelves and Racks
Skylight Latches
Vents, Louvers, Chutes
Columns
Bridging
Trusses
Rafters
Purlins
Braces
King and Queen Posts
Wall Plates
Ridge Pieces
Valley and Hip Pieces
Partition Studding
Trenching and Sheathing
Anchors, Strings
Flag Pole
Plumbers Wood Work
Cutting and Jobbing for others
Fireproofing Wood
Bucks
Window Frames and Sash

Girders
Floor Joists
Ceiling Joists
Grounds
Rough Hardware

Millwork

Exterior Doors and Transoms
Main Entrance Doors and Transoms
Vestibule Doors and Transoms
Revolving Door
Interior Corridor Door and Transom
Closet and Toilet Doors
Revolving Sash
Interior and Exterior Box and Plank Trim
Interior Partition Windows
Window Shutters
Venetian Blinds
Covers and Grilles for Radiators
Window Seats
Base
Chair Rail
Picture and Wire Mold
Doors for Pipe and Wire Shafts
Cutout Boxes and Doors
Telephone Chute Doors
W. C. Doors and Partitions
Elevator Doors
Dumbwaiters
Stair and Hand Rail
Wainscot Plain
Wainscot Paneled
Partitions, plain
Partitions, paneled
Partitions, sash work
Sash in Iron Frames
Ceiling Lights
Cornices

Kalameined Work

Tin Covered Roof and Boiler Room Doors
Tin Covered Fire Shutters
Metal Covered Exterior Room Doors
Metal Covered Interior Doors
Metal Covered Exterior Box Windows
Metal Covered Interior Plank Windows
Metal Covered Exterior Plank Windows
Metal Covered Interior Box Windows
Metal Covered Trim
Metal Covered Base
Metal Covered Chair Rail
Metal Covered Picture Mold
Metal Box Frames and Sash
Metal Plank Frames and Sash

Lathing and Plastering

Wood Furring and Plastering
Wood Furring and Lath Cornices
Wood Furring and Lath Hung Ceiling
Metal Corner Beads
Metal Partitions
Stamped Metal Work
Common Plaster, 2 or 3 coats
Patent Plaster, 2 or 3 coats
Patent Plaster, with wainscot
Patent Plaster, with trim
Patent Plaster, with base
Plain Plaster Coves
Moulded Plaster Coves and Cornices
Ornamental Plaster Cornices
Ornamental Plaster Ceilings and Walls
Ornamental Plaster Columns, Caps and Bases
Ornamental Plaster Architrave Bases
Ornamental Plaster Medallions and Festoons
Ornamental Plaster Brackets
Modeling
Papier Mâché Ornaments
Scagliola Wainscot Base and Cap
Scagliola Columns, Caps and Bases
Scagliola Ornaments

Sheet Metal and Roofing

Roofing Copper, Tin, Galvanized Iron
Flashing Copper, Tin
Gutter Lining, Copper, Galvanized Iron
Gutters, Copper, Galvanized Iron
Moulded Gutter Cornices
Skylights, Copper or Galvanized Iron
Cresting
Balustrades
Slate Roofing
Composition Roofing
Asphalt Roofing
Tile Roof

Leaders and Leader Boxes
Leaders, Boots and Shoes
Cornices, Copper or Galvanized Iron
Spanish Tile Roof
Metal Bay Windows
Sheathing

Marble, Mosaic, Terrazzo, Slate and Tile

Marble Wall Lining
Marble Wainscot (kinds and heights)
Marble Columns, Caps and Bases
Marble Brackets and Ornaments
Marble Architrave and Trim
Marble Plinth Blocks
Marble Base or Wash
Marble Saddles
Marble Counter Top or Sides
Marble Floor
Marble Bank Screen
Stair Treads
Stair Risers
Stair Platforms
Stair Newels
Stair Balustrades
W. C. Partitions
W. C. Stiles
W. C. Safes
Urinal Partitions
Urinal Backs
Urinal Safes
Wash Basin Tops
Wash Basin Apron
Wash Basin Back and Sides
Wash Basin Safe
Mosaic Floor
Mosaic Wall Boards
Terrazzo Floor Plain
Terrazzo Floor with Boards
Terrazzo Base
Slate Work
Alberene Stone
Caen Stone
Tile Floor
Tile Wall Lining
Tile Wainscot, cap and base
Fireplaces
Rubber Tiling

Structural Steel

Riveted Columns
Cast-iron Columns
Girders
Beams
Struts
Sheave Beams
Wind Bracing
Trusses
Caissons
Stack
Tie Rods
Rivets, Bolts and Nuts
Cast-iron Bases
Cast-iron Separators
Cast-iron Wall Plates
Cast-iron Anchors

Plumbing and Gas Fitting

Sprinkler System
Ejectors
Pumps, Electric and Steam
Filters
Fire Line and Hose Reels
Hot Water Generators
W. C. Fixtures
Urinal Fixtures
Wash Basin Fixtures
Slop Sink Fixtures
Shower Bath Fixtures
Sump Pit Tank
Tanks
Drains

Painting

All Trim Work
Sash Frames
Oiling Floors
All Ornamental Iron Work
Sidewalk Beams
Iron Columns
Pipes, exposed
Metal Cornice
Whitewashing
Cold Water Paint
Kalcemining
Tinting and Decorating

Stack
Tanks

Aluminum Finish

Hardware

Door Locks and Eyes
Door Escutcheons and Knobs
Door Butts
Door Checks
Window Pulls
Window Locks
Window Pole Sockets
Window Pole Tips

Transom Hinges
Transom Pivots
Transom Lifts
W. C. Door
W. C. Door Locks or Latches
W. C. Partition Standards
W. C. Coat Hooks
Kick Plates

Miscellaneous

Pneumatic Tube System
Window Shades
Cuspidors
Furniture

Rubber Mats
Scales
Awnings
Stable Fittings

Building Trades Wages, per Hour, in All of the Principal Cities

City	Bricklayer	Carpenter	Cement finisher	Electrician	Elevator constructor	Hoisting engineer	Notes
Akron, Ohio	$ 1.00	$ .80- 95	$.75-.90	$.80-1.00	$ 1.06	$ .70-.80	Open shop except bricklayer, plasterer, elevator constructor. Agreements expire 3/1/1923.
Albany, N. Y.	1.12½	1.00	1.12½	1.00	.90	1.00	Closed shop, except electrician, carpenter, painter, laborers.
Allentown, Bethlehem, Pa.	1.25	.90	1.00	1.00	1.25	1.00	Most trades open shop. Agreements expire 4/30/1923.
Atlanta, Ga	1.00-1.50	.70- 80	1.00-1.25	.75-1.00	.....	.75-1.00	Open shop.
Atlantic City, N. J.	1.50	1 12½	1.10	1 12½	1.25	1.25	Closed shop most trades.
Baltimore, Md.	1.25	.90	1.25	1.00	1.06	1.12½	Closed shop.
Boston, Somerville, Mass.	1.25	1 05	1.05	1.05	1.15	1.05	Closed shop.
Birmingham, Ala	1.12½	87½	1.00	1.00	1.00	.75	Open shop. No agreements.
Bridgeport, Conn.	1.25	1.00-1.12½	1.25	1.00	1.25	1.12½	Open shop most trades.
Buffalo, N. Y.	1.25	1.00	.85	90	.97½	1.00	Open shop. No agreements.
Butte, Mont.	1.37½	1.12½	1.50	1.12½	.....	.87½	Closed shop.
Canton, Ohio	1.25-1.50	.90-1.05	.70- 90	.75	.....	.80-1.00	Open shop. No agreements.
Chicago, Ill.	1.25	1.15*	1.10*	1.25	1.25	1.00-1.25*	Closed shop most trades. Open shop.*
Cincinnati, Ohio	1.25	1 10	1.02½	1 10	1.10	1.10	Closed shop. Agreements expire 12/23/1923.
Cleveland, Ohio	1.40	1 25	1.25	1.25	.....	1.25	Closed shop. Agreements expire 3/1/1923.
Columbus, Ohio	1.37½	1 00	.80	70-.80	.90	.90	Open shop. No agreements.
Dallas, Texas	1.37½	1 00	1.00	1.00	.....	.90	Open shop.
Davenport, Clinton, Ia.	1.25	1 00	1.00	1.00	.....	1.00	Closed shop. Agreements expire 5/1/1924.
Dayton, Ohio	1.25	1.00	1.00	1.15	.....	1.10	Closed shop. Agreements expire 12/31/1923.
Denver, Colo.	1.37½	1 12½	1.12½	1.12½	1.15	1.12½	Open shop.
Des Moines, Ia.	1.25	1.00	1.12½	1.00	1.00	1.00	Closed shop, except electrician. Agreements expire 4/1/1924.
Detroit, Mich.	1.50	.75- 90	.60-.85	1.12½	1.00	.80-.95	Open shop.
Duluth, Minn	1.12½	.87½	.87½	.87½	.87½	.87½	Open shop. Maximum rates.
Elizabeth, N. J.	1.25	1.10	1.25	1.12½	.....	1.25	Open. Agreements expire on 90 days' notice.
Ei Paso, Texas	1.25	1.00	.62½-1.00	1.12½	.....	1.00	Open shop most trades.
Erie, Pa.	1.25	.95	1.12½	80	.90	1.00	Open shop, except bricklayer, plasterer, plumber.
Fall River, Mass.	1.12½	.85- 95	.....	.85-.90	.....	.....	Open shop.
Flint, Mich.	1.25	.85	.85	.85	.....	.85	Open shop.
Fort Wayne, Ind.	1.25	.75-.95	.90	.75-.90	.....	.90-1.00	Open shop. No agreements.

Fort Worth, Texas	1.37½	1.00	1.00	1.00	1.00	.75–1.00	Open shop.
Grand Rapids, Mich	1.25	.80	.80–.90	.80–.90	.....	.80–1.00	Open shop.
Hartford, Conn	1.12½	1.00	.85	1.00	1.00	1.00	Open shop.
Houston, Galveston, Tex	1.37½	1.00	1.12½	1.12½	1.00	1.00	Closed. Electrician, plasterer, hod carrier, sheet metal in Galveston $1 day less.
Indianapolis, Ind	1.35	.97½	.95	1.10	1.25	1.15–1.25	Closed shop except roofer, laborers. Agreements expire 4/1/1923.
Jacksonville, Fla	.87½–1.12½	40–.80	.60	.85	1.00	.60–.75	Open shop.
Jersey City, Hoboken, Bayonne, N. J	1.50	1.12½	1.12½	1.25	1.25–1.37½	.....	Closed shop.
Kansas City, Mo	1.37½	1.12½	1.00	1.25	1.12½	1.00–1.25	Closed shop. Unsettled.
Knoxville, Tenn	1.25–1.50	.70	.50	.....	.....	.40	Plasterer, painter, sheet metal, carpenter, laborers. Open shop.
Lawrence, Mass	1.25	1.00	1.25	1.05	.....	1.05	Closed shop.
Little Rock, Ark	1.25	.50–.95	1.25	87½–.92½	.....	.80	Open shop.
Los Angeles, Pasadena, Cal	1.25	.87½–1.00	1.25	87½–1.00	.80–1.00	.75–1.00	Open shop. No agreements.
Louisville, Ky	1.25	.80	.80–1.00	.75–.87½	.90	.....	Closed shop.
Lowell, Mass	1.25	1.00	1.00	.90	.....	1.00–1.25	Closed shop.
Lynn, Mass	1.25	1.00	1.12½	1.10	.85–1.00	1.25	Closed shop.
Manchester, N. H	1.12½	.90	1.12½	1.00	.....	.85–1.00	Open shop. No agreements.
Memphis, Tenn	1.37½	.60–.85	60–.85	.80–.87½	1.00	.75–1.00	Open shop most trades.
Milwaukee, Wis	1.25	.95	.65–.75	1.00	1.12½	1.00	Open shop.
Minneapolis, Minn	1.12½	.87½	.87½	.87½	.....	.87½	Open shop.
Montreal, Can	1.00	.65	.70	.65	.....	30.00 wk.	Closed shop except roofer, laborer.
Nashville, Tenn	1.25	.65	.50–.60	.75	.75–1.00	.65	Open shop most trades.
Newark, N. J., Orange, N. J	1.25	1.12½	1.25	1.12½	.....	1.25	Closed shop. Agreements expire 4/1/1923.
New Bedford, Mass	1.25	1.00	1.25	.90	.....	1.05	Open shop most trades. No agreements.
New Haven, Conn	1.12½	.90	1.00	.80	1.00	.90	Open shop most trades.
New Orleans, La	1.00	.85	1.00	.90	1.00	.90	Closed shop.
New York, N. Y	1.50	1.12½	1.12½	1.12½	1.12½	1.25	Closed shop.
Norfolk, Va	1.25	.65–.75	.50–.65	.65–.75	1.05	.50–.75	Open shop most trades. No agreements.
Oakland, Berkeley, Cal	1.25	1.00	1.06¼	1.00	1.05	1.00	Open shop.
Oklahoma City, Okla	1.50	1.00	.90	1.00	.90	.85	Open shop.
Omaha, Neb	1.25	1.00	.90	1.12½	1.12½	1.12½	Open shop. No agreements.
Ottawa, Can	1.00	.75	.....	.80	.....	.75	Closed shop. Agreements expire 5/1/1924.
Paterson, N. J	1.25–1.50	1.12½	1.12½	1.12½	1.12½–1.25	1.25	Closed shop except painter, laborer. Agreements expire 5/1/1924.
Peoria, Ill	1.25	1.00	1.00	1.05	.....	1.00	Closed shop. Agreements expire 4/1/1924.
Philadelphia, Pa., Camden, N. J	1.37½–1.50	1.00–1.12½	1.00	.90–1.12½	1.15	45.00 wk.	Open shop.

BUILDING TRADES WAGES, PER HOUR, IN ALL OF THE PRINCIPAL CITIES.—*(Continued)*.

City	Bricklayer	Carpenter	Cement finisher	Electrician	Elevator constructor	Hoisting engineer	Notes
Pittsburgh, Pa., Allegheny, Pa.	$ 1.40	$ 1.20	$ 1.12½	$ 1.25	$ 1.16	$1.12½–1.25	Closed shop. Agreements expire 2/28/1924.
Portland, Ore.	1.25	1.00	1.00	1.00	1.04½	1.12½	Closed shop.
Providence, R. I.	1.25	1.00	1.10	1.00	.....	1.25	Closed shop.
Reading, Pa.	1.25	.90	.90	.90	1.00	1.25	Open shop.
Richmond, Va.	1.50	.80	.80–1.00	.90	.....	.90	Open shop.
Rochester, N. Y.	1.25	1.00	1.25	1.08	1.00	1.10	Closed shop, except engineers, laborers. Agreements expire 4/1/1924.
Rockford, Ill.	1.10	1.02½	.80	.81¼	.80	.80	Open shop.
Rock Island, Ill., Moline, Ill.	1.25	1.00	1.00	1.00	.....	1.00	Closed shop. Agreements expire 5/1/1924.
San Antonio, Texas	.87½–1.37½	.62½–.87½	.87½–1.25	.75–.87½	1.00	.50–.75	Open shop. No agreements.
San Diego, Cal.	1.25	.87½–1.00	.62½–1.00	.87½	.....	.80–1.00	Open shop.
San Francisco, Cal.	1.25	1.00	1.06¼	1.00	1.00	1.00	Open shop. Unsettled. Agreements expire 1/1/1923.
Salt Lake and Ogden, Utah	1.12½	1.00	1.00	1.00	1.00	1.00	Open shop. No agreements.
Savannah, Ga.	.90	.75	.75	1.00	.90	1.00	Open shop.
Seattle, Wash.	1.25	1.00	1.00	1.00	.....	.87½–1.12½	Open shop. Agreements expire 5/1/1924.
Schenectady, N. Y.	1.12½	1.00	1.12½	1.00	.....	.....	Closed. No agreement except carpenter, painter.
Scranton, Pa.	1.37½	1.00	.60	1.00	.....	1.00	Closed shop.
Shreveport, La.	1.50	1.00	1.25	1.12½	.....	1.00	Open shop most trades.
Sioux City, Ia.	1.25	.90	.90	1.00	.....	.80	Open shop most trades.
Spokane, Wash.	1.25	1.00	1.25	.90	.90	1.00	Close shop most trades. No agreements.
Springfield, Holyoke, Mass.	1.25	1.25	1.12½	.95	1.10	1.00	Closed shop most trades.
St. Joseph, Mo.	1.12½	.87½	.87½	.87½	.....	1.25	Open shop most trades. No agreements.
St. Louis, Mo., E. St. Louis, Ill.	1.50	1.25	1.25	1.25	1.25	1.25–1.37½	Closed shop. Agreements expire 3/1/1924.
St. Paul, Minn.	1.12½	.87½	.87½	.87½	1.05	.87½	Open shop. Maximum rates.
Syracuse, N. Y.	1.25	1.00	1.00	1.12½	1.00	1.00	Closed shop. Most agreements expire 12/31/1923.
Tacoma, Wash.	1.25	.87½	1.12½	1.00	.....	1.00–1.12½	Open shop.
Toledo, Ohio	1.35	1.00	.95	.60–1.00	1.15½	.60–.75	Open shop. No agreements.
Toronto, Can.	1.00	.90	.70–.75	.80	.....	.75–.80	Open shop most trades.
Trenton, N. J.	1.25–1.50	1.12½	1.25	1.25	1.25	1.25	Closed shop. Most agreements expire 12/31/1923.
Troy, N. Y.	1.12½–1.25	1.00	1.12½	1.00	1.00	1.00–1.25	Closed shop most trades.

Utica, N. Y.	1.25	1.00	1.25	.89	1.00	.85	Open shop except bricklayer, plasterer, electrician.
Vancouver, B. C.	1.06¼	.81¼	.87½	.90	.....	.87½	Open shop. No agreements.
Washington, D. C.	1.25–1.37½	1.12½	1.12½	1.06¼	1.25	1.25	Closed shop. No agreements.
Waterbury, Conn.	1.12½–1.25	.90–1.00	1.12½	.80	1.00	1.00	Open shop.
Wheeling, W. Va.	1.25	.90	.....	.90	.....	.....	Open shop.
Wilmington, Del.	1.15	.80–.85	1.12½	.85–.90	.....	.85–1.00	Open shop.
Winnipeg, Man.	1.10	.85	.70	.85	.....	.....	
Worcester, Mass.	1.25	1.00	1.00	1.00	1.00	1.10	Open shop most trades.
Youngstown, Ohio	1.25	1.15	1.25	1.00	.....	.....	Closed shop.

BUILDING TRADES WAGES, PER HOUR, IN ALL OF THE PRINCIPAL CITIES.—(*Continued*)

City	Architectural iron	Structural iron	Lather	Marble setter	Painter	Notes
Akron, Ohio	$ 80- 90	$ 80-.90	$1.00-1.25	$1.12½	$.80-.95	Open shop, except bricklayer, plasterer, elevator constructor. Agreements expire 3/1/1923.
Albany, N. Y.	1.00	1.00	1.00	.....	.95	Closed shop except electrician, carpenter, painter, laborers.
Allentown, Bethlehem, Pa.	1.00	1.00	1.25	1.25	1.00	Most trades, open shop. Agreements expire 4/30/1923.
Atlanta, Ga.	.50-.60	.50-.60	.90	.....	.70	Open shop.
Atlantic City, N. J.	1 25	1.25	1.25	1.50	1.00	Closed shop most trades.
Baltimore, Md.	1.10	1.25	1.25	1.25	.80	Closed shop.
Boston, Somerville, Mass.	1.05	1.05	1.12½	1.05	1.05	Closed shop.
Birmingham, Ala.	1 00	1.00	.80	1.00	.85	Open shop. No agreements.
Bridgeport, Conn.	1 12½	1.12½	1.12½	1.25	1.00	Open shop most trades.
Buffalo, N. Y.	.75	1.00	1.25	1.00	.75- 87½	Open shop. No agreements.
Butte, Mont.	1.12½	1.12½	1.25	.....	1.12½	Closed shop.
Canton, Ohio	.....	1.00	1.25-1.50	1.25	.80-1.10	Open shop. No agreements.
Chicago, Ill.	1.25	1.25	1.12½*	1.25	.95-1.25*	Closed shop most trades. Open shop *.
Cincinnati, Ohio	1.10	1.10	1.10	1 12½	1.02½	Closed shop. Agreements expire 12/23/1923.
Cleveland, Ohio	.....	1.37½	1.25	1.40	1.20	Closed shop. Agreements expire 3/1/1923.
Columbus, Ohio	1.00	1.00	1.10	1.00	.65-.85	Open shop. No agreements.
Dallas, Texas	.....	.....	1.00	1.12½	.75-1.00	Open shop.
Davenport, Clinton, Ia.	1.12½	1.12½	1.25	1.00	1.00	Closed shop. Agreements expire 5/1/1924.
Dayton, Ohio	.....	.....	1.17½	.95	1.00	Closed shop. Agreements expire 12/31/1923.
Denver, Colo.	.....	1.15⅝	1.25	1.37½	1.12½	Open shop.
Des Moines, Ia.	1.00	1.00	1.25	1.00	1.00	Closed shop, except electrician. Agreements expire 4/1/1924.
Detroit, Mich.	.80-.90	.90-1.00	1.12½	1.12½	.75-.85	Open shop.
Duluth, Minn.	.87½	.87½	.87½	1.10	.87½	Open shop. Maximum rates.
Elizabeth, N. J.	1.25	1.25	1.37½	.....	1.06¼	Open. Agreements expire on 90 days' notice.
El Paso, Texas	1.00	1.00	1.00	1.25	1.00	Open shop most trades.
Erie, Pa.	1.00	1.00	1.25	1.10	.80- 85	Open shop, except bricklayer, plasterer, plumber.
Fall River, Mass.	.....	.90-1.00	.85-.95	1.12½	.80- 90	Open shop.
Flint, Mich.	.....	.....	1.00	1.12½	.85	Open shop.
Fort Wayne, Ind.	1.00	1.00	1.00	1.00	.80-.90	Open shop. No agreements.

Fort Worth, Texas	.....	.....	1.00	1 37½	.75–1.00	Open shop.
Grand Rapids, Mich	.....	.80–1.00	1.25	1.00	.75–.85	Open shop.
Hartford, Conn	.90	1.00	1.00	1.12½	.90	Open shop.
Houston, Galveston, Tex	1.06¼	1 06¼	1.37½	1.12½	1.00	Closed. Electrician, plasterer, hod carrier, sheet metal in Galveston $1 day less.
Indianapolis, Ind	.....	1.25	1.02½	1.12½	.97½	Closed shop, except roofer, laborers. Agreements expire 4/1/1923.
Jacksonville, Fla	60–90	.60–.90	60–.70	.....	.62–.75	Open shop.
Jersey City, Hoboken, Bayonne, N. J	1.12½	1.12½	1.12½	1.25	1.12½	Closed shop.
Kansas City, Mo	.....	1.07½	1.00–1.25	1.12½	1.00	Closed shop. Unsettled.
Knoxville, Tenn	.....	.75–.80	.60–.75	1.00	.65–.75	Plasterer, painter, sheet metal, carpenter, laborers. Open shop.
Lawrence, Mass	.....	1.00	1.00	.....	1.00	Closed shop.
Little Rock, Ark	.75–.87½	.75–.87½	.....	1.00	.75–1.00	Open shop.
Los Angeles, Pasadena, Cal	.95	.87½	1.25	1.12½	1.00	Open shop. No agreements.
Louisville, Ky	1.00	1.00	1.00	1.00	.50–.87½	Closed shop.
Lowell, Mass	.....	.....	1 00	.....	1.00	Closed shop.
Lynn, Mass	1.25	1.25	1 06¼	.....	1.00	Closed shop.
Manchester, N. H	.50–1.00	.50–1.00	1 12½	1.00	.70–.80	Open shop. No agreements.
Memphis, Tenn	.75–1 00	.75–1 00	.75–1.00	1.25	.87½	Open shop most trades.
Milwaukee, Wis	1.00	1.00	1.12½	1 06¼	.85	Open shop.
Minneapolis, Minn	.87½	.87½	.87½	1 10	.87½	Open shop.
Montreal, Can	.65	.50–.75	1.25	.75	.65–.70	Closed shop, except roofer, laborer.
Nashville, Tenn	.75	.60–.70	.82½–1.00	1.25	.62½–.75	Open shop most trades.
Newark, N. J., Orange, N. J	.....	1.25	1.25	1.25	1.12½	Closed shop. Agreements expire 4/1/1923.
New Bedford, Mass	.....	1 05	1.25	1.25	.90	Open shop most trades. No agreements.
New Haven, Conn	1.06¼	1 06¼	1.12½	1.12½	.80	Open shop most trades.
New Orleans, La	1 00	1 00	1.25	1.25	.80	Closed shop.
New York, N. Y	1.12½	1.12½	1.12½	1.12½	1.25	Closed shop.
Norfolk, Va	.75–.85	.75–.85	.75	1.12½	.65–.75	Open shop most trades. No agreements.
Oakland, Berkeley, Cal	.87½	1.12½	1.00	1.00	1.00	Open shop.
Oklahoma City, Okla	1.00	1.00	.90	1.00	1.00	Open shop.
Omaha, Neb	1.12½	1.12½	1.12½	1.12½	.90–1.00	Open shop. No agreements.
Ottawa, Can	.75	.60	.70	1.00	.70–.75	Closed shop. Agreements expire 5/1/1924.
Paterson, N. J	1 25	1.25	1.12½	1.12½	1.00	Closed shop except painter, laborer. Agreements expire 5/1/1924.
Peoria, Ill	1.00	1.00	1.25	1 12½	.80–1.00	Closed shop. Agreements expire 4/1/1924.
Philadelphia, Pa Camden, N. J	1.10	1.12½	1.25–1.50	1.12½	.90	Open shop.
Pittsburgh, Pa., Allegheny, Pa	1.25	1.25	1.25	1.12½	1.25	Closed shop. Agreements expire 2/28/1924.

BUILDING TRADES WAGES, PER HOUR, IN ALL OF THE PRINCIPAL CITIES.—(*Continued*)

City	Architectural iron	Structural iron	Lather	Marble setter	Painter	Notes
Portland, Ore.	$ 1.12½	$ 1.12½	$1.00–1.12½	$ 1.25	$ 1.00	Closed shop.
Providence, R. I.	1.00	1.00	1.00	1.15	1.00	Closed shop.
Reading, Pa.	.80	1.25	1.00	1.10	.85	Open shop.
Richmond, Va.	.85–1.00	1 00	.75–1.00	1.00	.75	Open shop.
Rochester, N. Y.	1.06¼	1.06¼	1.00	1.12½	1.00	Closed shop except engineers, laborers. Agreements expire 4/1/1924.
Rockford, Ill.	1.12½	1.12½	.90–1.25	1.00–1.10	.80	Open shop.
Rock Island, Ill., Moline, Ill.	1.12½	1.12½	1.25	1.00	1.00	Closed shop. Agreements expire 5/1/1924.
San Antonio, Texas	.75–1.00	.75–1.00	1.00–1.12½	1.12½	.75–87½	Open shop. No agreements.
San Diego, Cal.	.87½	.87½	.87½–1.00	.....	.87½–1.00	Open shop.
San Francisco, Cal.	.87½	1.12½	1.00	1.00	1.00	Open shop. Unsettled. Agreements expire 1/1/1923.
Salt Lake and Ogden, Utah	1.00	1.00	1.12½–1.25	1.12½	1.00	Open shop. No agreements.
Savannah, Ga.	1.50	1.00	.75	1.00	.62½	Open shop.
Seattle, Wash.	.....	1.00–1.12½	1.12½–1.25	1.25	.89–1.00	Open shop. Agreements expire 5/1/1924.
Schenectady, N. Y.	.....	.....	1.00	1.12½	1.10	Closed. No agreement except carpenter, painter.
Scranton, Pa.	1.00	1.00	1.00	1.50	.87½	Closed shop.
Shreveport, La.	.....	1.12½	1.25	1.25	1.00	Open shop most trades.
Sioux City, Ia.	.75	.75	.90	.....	.80	Open shop most trades.
Spokane, Wash.	1.00	1.00	1.00	1.00	1.00	Closed shop most trades. No agreements.
Springfield, Holyoke, Mass.	1.12½	.....	1.12½	1.12½	1.00	Closed shop most trades.
St. Joseph, Mo.	1.00	1.00	1.00	1.25	.87½	Open shop most trades. No agreements.
St. Louis, Mo., E. St. Louis, Ill.	1.25	1.25	1.37½	1.25	1.12½	Closed shop. Agreements expire 3/1/1924.
St. Paul, Minn.	.87½	.87½	.87½	1.12½	.87½	Open shop. Maximum rates.
Syracuse, N. Y.	.....	1.12½	1.25	1.12½	1.00	Closed shop. Most agreements expire 12/31/1923.
Tacoma, Wash.	1.12½	1.12½	6.00 M.	1.25	.90	Open shop.
Toledo, Ohio	.60–.75	.50	1.25	1.12½	.75–.80	Open shop. No agreements.
Toronto, Can.	.75–.85	.75–.85	1.12½	1.00	.75	Open shop most trades.
Trenton, N. J.	1.25	1.25	1.12½	1.12½	1.12½	Closed shop. Most agreements expire 12/31/1923.
Troy, N. Y.	1.12½	1.12½	1.00	1.12½	.95	Closed shop most trades.

Utica, N. Y.	1.00	1.00	1.00	1.12½	.85	Open shop, except bricklayer, plasterer, electrician.
Vancouver, B. C.	1.12½	1.12½	1.00	1.06¼	.75	Open shop. No agreements.
Washington, D. C.	1.25	1.25	.....	1.12½	1.12½	Closed shop. No agreements.
Waterbury, Conn.	.....	1.06¼	1.12½	1.12½	.80–1.00	Open shop.
Wheeling, W. Va.	1.00	1.00	1.00	.....	.90	Open shop.
Wilmington, Del.	.....	.....	1.12½	1.12½	.85	Open shop.
Winnipeg, Man.	.90	.90	.80	1.05	.75	
Worcester, Mass.	1.12½	1.12½	1.00	1.12½	1.00	Open shop most trades.
Youngstown, Ohio	1.00	1.00	1.25	1.12½	1.15	Closed shop.

BUILDING TRADES WAGES, PER HOUR, IN ALL OF THE PRINCIPAL CITIES.—(*Continued*)

City	Plasterer	Plumber	Roofer		Sheet metal	Sprinkler Fitter	Notes
			Comp.	Slate			
Akron, Ohio	$1.25	$ .85–1.00	$ .80–.90	$ .80–.90	$ .80–.90	.....	Open shop, except bricklayer, plasterer, elevator constructor. Agreements expire 3/1/1923.
Albany, N. Y.	1.12½	1.00	1.00	1.00	1.00	.....	Closed shop, except electrician, carpenter, painter, laborers.
Allentown, Bethlehem, Pa.	1.25	1.00	1.00	1.00	1.00	$ 1.00	Most trades open shop. Agreements expire 4/30/1923.
Atlanta, Ga.	1.00–1.25	1.00	.....	.60–.70	.60–.90	.....	Open shop.
Atlantic City, N. J.	1.50	1.15	75–1.00	1.15	1.15	1.15	Closed shop most trades.
Baltimore, Md.	1.50	1.00	1.12½	1.12½	.90	.....	Closed shop.
Boston, Somerville, Mass.	1.25	1.10	1.05	1.05	1.05	1.05	Closed shop.
Birmingham, Ala.	1.25	1.50	.50	1.00	1.00	1.50	Open shop. No agreements.
Bridgeport, Conn.	1.25	1.00	1.00	1.00	1.00	1.00	Open shop most trades.
Buffalo, N. Y.	1.50	1.00	.50–.60	1.00	1.00	.....	Open shop. No agreements.
Butte, Mont.	1.50	1.25	.68¾	.....	.....	.....	Closed shop.
Canton, Ohio	1.25–1.50	.90	.60–.65	1.00	.80–1.00	.90	Open shop. No agreements.
Chicago, Ill.	1.25	1.15*	1.10*	1.15*	1.15*	1.25	Closed shop most trades. Open shop .*
Cincinnati, Ohio	1.25	1.10	85	1.10	.95	1.10	Closed shop. Agreements expire 12/23/1923.
Cleveland, Ohio	1.25	1.30	1.10	1.37½	1.25	.....	Closed shop. Agreements expire 3/1/1923.
Columbus, Ohio	1.25–1.37½	1.00	.90	.90–1.00	.90–1.00	.....	Open shop. No agreements.
Dallas, Texas	1.37½	1.37½	.75	1.00	.75–1.00	1.12½	Open shop.
Davenport, Clinton, Ia.	1.25	1.12½	1.00	1.00	1.00	.....	Closed shop. Agreements expire 5/1/1924.
Dayton, Ohio	1.25	1.15	.80	1.10	1.10	.....	Closed shop. Agreements expire 12/31/1923.
Denver, Colo.	1.25	1.18¾	1.00	.....	1.12½	.....	Open shop.
Des Moines, Ia.	1.37½	1.25	.85	.85	1.00	.....	Closed shop except electrician. Agreements expire 4/1/1924.
Detroit, Mich.	1.50	1.00–1.25	.60–.80	.70–.90	.70–.90	1.00	Open shop.
Duluth, Minn.	1.12½	.87½	.82½	.82½	.87½	.87½	Open shop. Maximum rates.
Elizabeth, N. J.	1.25	1.25	1.25	1.25	1.12½	.....	Open. Agreements expire on 90 days' notice.
El Paso, Texas	1.25	1.25	1.00	1.00	1.00	.....	Open shop most trades.
Erie, Pa.	1.25	1.00	.80	.80	.90	.....	Open shop, except bricklayer, plasterer, plumber.
Fall River, Mass.	1.12½	.85–.90	.75–.85	.....	.80–.90	.....	Open shop.
Flint, Mich.	1.25	.90	.85	.85	.85	.....	Open shop.
Fort Wayne, Ind.	1.12½	.80–.90	.....	.....	.70–.80	.80–.90	Open shop. No agreements.

Fort Worth, Texas	1 00	1.00	.75–1.00	1.00–1.25	1.12½	.....	Open shop.
Grand Rapids, Mich	1.25	.90–1.00	.70–.80	.70–.80	.90–.95	.....	Open shop.
Hartford, Conn	1.12½	1.00	.75	.90	.90	85-1.00	Open shop.
Houston, Galveston, Tex	1.50	1.25	1.00	1.12½	1.12½	.....	Closed. Electrician, plasterer, hod carrier sheet metal in Galveston $1. day less.
Indianapolis, Ind	1.37½	1.22½	.45–.75	.....	.97½	.....	Closed shop except roofer, laborer. Agreements expire 4/1/1923.
Jacksonville, Fla	1.25	1 12½	.80–.90	.80–.90	.75–1.00	.....	Open shop.
Jersey City, Hoboken, Bayonne, N. J	1 50	1.25	1.12½	1.12½	1.25	1.25	Closed shop.
Kansas City, Mo	1 37½	1.25	.85	1.00	1.00	1 25	Closed shop. Unsettled.
Knoxville, Tenn	.87½	1.12½	.70	.70	.70	.....	Plasterer, painter, sheet metal, carpenter, laborers. Open shop.
Lawrence, Mass	1.25	1 05	1.00	1.00	1.05	.....	Closed shop.
Little Rock, Ark	1.12½	1.12½	.70	.....	.90	.....	Open shop.
Los Angeles, Pasadena, Cal	1.25–1.37½	1 12½	1.00	.....	1.00	1.00	Open shop. No agreements.
Louisville, Ky	1 25	1 25	.80	.....	.80	.....	Closed shop.
Lowell, Mass	1 12½	1 10	1.00	1.00	1.00	.....	Closed shop.
Lynn, Mass	1 25	1.12½	1.00	1.10	1.12½	1 12½	Closed shop.
Manchester, N. H	1 12½	.90–1.00	.70	.90	1.00	90–1.00	Open shop. No agreements.
Memphis, Tenn	1 37½	1.17½	.40	.87½	.87½	1 00–1 25	Open shop most trades.
Milwaukee, Wis	1 25	1.12½	.82½	.87½	75–.85	.....	Open shop.
Minneapolis, Minn	1 12½	.87½	.82½	.....	.87½	.....	Open shop.
Montreal, Can	1 25	.75	.55	75	.65	.75	Closed shop except roofer, laborer.
Nashville, Tenn	1 25–1.50	1.00–1 12½	.65	.....	.75	.....	Open shop most trades.
Newark, N. J., Orange, N. J	1 25	1.12½	1 00	1 25	1.12½	.....	Closed shop. Agreements expire 4/1/1923.
New Bedford, Mass	1 25	90	.75	.90	.90	1 00	Open shop most trades. No agreements.
New Haven Conn	1 12½	1.00	1 00	.....	1.00	1.00	Open shop most trades.
New Orleans, La	1 00	.90	.80	1.00	.90	.....	Closed shop.
New York, N. Y	1 50	1.25	1 00	1.25	1.12½	1.12½	Closed shop.
Norfolk, Va	1 00–1.25	1 00	.50–.60	.75–.87	.75–.87½	.....	Open shop most trades. No agreements.
Oakland, Berkeley, Cal	1 25	1 12½	1.00	1.00	1.06¼	.90	Open shop.
Oklahoma City, Okla	1 25	1 12½	.90	1.00	1.00	.90	Open shop.
Omaha, Neb	1 25	1.12½	1.00	1.00	1 00	.....	Open shop. No agreements.
Ottawa, Can	85	.80	.50	.75–.90	.75–.90	.80	Closed shop. Agreements expire 5/1/1924.
Paterson, N. J	1 25-1.50	1.25	1.00	1.25	1.12½	1.12½	Closed shop except painter, laborer. Agreements expire 5/1/1924.
Peoria, Ill	1.37½	1 12½	.....	1.00	1.00	1.00	Closed shop. Agreements expire 4/1/1924.
Philadelphia, Pa., Camden, N. J	1 25–1 50	1.00–1.15	.80	.90	1.00	1.00	Open shop.
Pittsburgh, Pa., Allegheny, Pa	1 37½	1.15⅝	1.00	1.25	1.20	1.25	Closed shop. Agreements expire 2/28/1924.

BUILDING TRADES WAGES, PER HOUR, IN ALL OF THE PRINCIPAL CITIES.—(*Continued*)

City	Plasterer	Plumber	Roofer		Sheet metal	Sprinkler fitter	Notes
			Comp.	Slate			
Portland, Ore.	$ 1.25	$ 1.12½	$ .87½	$ .87½	$ 1.00	.....	Closed shop.
Providence, R. I.	1.25	1.12½	.75	1.00	1.00	$ 1.00	Closed shop.
Reading, Pa.	1.25	1.00	.90	.90	.80	1.00	Open shop.
Richmond, Va.	1.00–1.50	.87½	.80	.80	.80	.....	Open shop.
Rochester, N. Y.	1 25	1.05	.90	.90	1.00	1.05	Closed shop, except engineers, laborers. Agreements expire 4/1/1924.
Rockford, Ill.	1.25	1.25	.65–.80	.....	.80–1.00	.....	Open shop.
Rock Island, Ill., Moline, Ill.	1 25	1.12½	1 00	1 00	1.00	.....	Closed shop. Agreements expire 5/1/1924.
San Antonio, Texas.	1.12½–1.37½	1.00–1.12½	.50–.75	.50–.75	1.00	.....	Open shop. No agreements.
San Diego, Cal.	1.25	1.12½	.75–1.00	.75–1.00	1.00	.....	Open shop.
San Francisco, Cal.	1.25	1.12½	1.00	1.00	1.06¼	.90	Open shop. Unsettled Agreements expire 1/1/1923.
Salt Lake and Ogden, Utah.	1 25	1.12½	.87½	1.00	1.00	1.00	Open shop. No agreements.
Savannah, Ga.	.94	1.25	1.00	.....	.75	.....	Open shop.
Seattle, Wash.	1 25	1.12½–1.25	1 00	1.00	1.00	.....	Open shop. Agreements expire 5/1/1924.
Schenectady, N. Y.	1.12½	1.10	1.00	1.00	1.00	1.10	Closed. No agreement except carpenter, painter.
Scranton, Pa.	1.37½	1.00	1.00	1.00	1.00	.....	Closed shop.
Shreveport, La.	1.50	1.25	1.00	.....	1.00	.....	Open shop most trades.
Sioux City, Ia.	1.00	1.00	.65	.65	.85	.....	Open shop most trades.
Spokane, Wash.	1 25	1 12½	1.00	1 00	.90	1.00	Closed shop most trades. No agreements.
Springfield, Holyoke, Mass.	1 25	1.00	70–.75	1.12½	.45–1.00	1.00	Closed shop most trades.
St. Joseph, Mo.	1 25	1.25	1.00	1.00	1.00	1.25	Open shop most trades No agreements.
St. Louis, Mo., E. St. Louis, Ill.	1 50	1.50	1.25	1.25	1.25	.....	Closed shop. Agreements expire 3/1/1924.
St. Paul, Minn.	1.12½	.87½	.82½	.82½	.87½	.87½	Open shop. Maximum rates.
Syracuse, N. Y.	1.25	1.05	.....	1.05	1.05	.....	Closed shop. Most agreements expire 12/31/1923.
Tacoma, Wash.	1.25	1.12½	.75–.90	.75–.90	1.00	.....	Open shop.
Toledo, Ohio.	1.25	1.00	50–.80	.50–.80	.75–.85	.....	Open shop. No agreements.
Toronto, Can.	1.25	.90	.75–.90	.75–.90	.80	.90	Open shop most trades.
Trenton, N. J.	1.25	1.12½	1.00	1.00	1.12½	1.12½	Closed shop. Most agreements expire 12/31/1923.
Troy, N. Y.	1.12½–1.25	1.00	1.00	1.00	1.00	.....	Closed shop most trades.

Utica, N. Y.	1.25	1.00	.85	.85	.85	1.00	Open shop except bricklayer, plasterer, electrician.
Vancouver, B. C.	1.06¼	1.00	.75	.....	.90	1.00	Open shop. No agreements.
Washington, D. C.	1 50	1.25	.62½	1 15	1.06¼	.....	Closed shop. No agreements.
Waterbury, Conn.	1.12½–1.25	1.00	1 00	.....	80–1.00	1.00	Open shop.
Wheeling, W. Va.	1.00	.90	.....	.80	.80	.....	Open shop.
Wilmington, Del.	1.37½	1.00	.80	.80	.80	1 00	Open shop.
Winnipeg, Man.	1.07½	.90	.....	.....	.80	.....	
Worcester, Mass.	1 25	1.00	1.00	1.00	1.00	1 00	Open shop most trades.
Youngstown, Ohio	1.25	1.00	1.12½	1.12½	1.12½	.....	Closed shop.

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BUILDING TRADES WAGES, PER HOUR, IN ALL OF THE PRINCIPAL CITIES.—(*Continued*)

City	Steam fitter	Stone cutter	Tile setter	Laborer	Hod carrier	Pipe coverer	Notes
Akron, Ohio	$.85–1.00	$1.25	$1.12½	$ 45–.55	$.65	.....	Open shop, except bricklayer, plasterer, elevator constructor. Agreements expire 3/1/1923.
Albany, N. Y.	1.00	.....	.....	.62½	.62½	.....	Closed shop, except electrician, carpenter, painter, laborers.
Allentown, Bethlehem, Pa.	1.00	1.25	1.25	.50	.85	$1.00	Most trades open shop. Agreements expire 4/30/1923.
Atlanta, Ga.	1.00	.....	1.12½	.25–.35	.35–.50	.60–.75	Open shop.
Atlantic City, N. J.	1.15	1.50	1.25	.45–.60	1.00	1.25	Closed shop most trades.
Baltimore, Md.	1.00	1.12½	.....	.35–.40	.87½	.90	Closed shop.
Boston, Somerville, Mass.	1.05	1.05	1.12½	.60	.65	1.05	Closed shop.
Birmingham, Ala.	1.50	1.00	1.00	30–.35	.50	1.50	Open shop. No agreements.
Bridgeport, Conn.	1.00	1.12½–1.25	1.12½–1.25	.56–.65	.56–.65	1.00	Open shop most trades.
Buffalo, N. Y.	1.00	1.00	1.00	50–.60	.50–.60	.90	Open shop. No agreements.
Butte, Mont.	.75	1.25	.....	.60	1.00	.....	Closed shop.
Canton, Ohio	.90	1.25	1.12½	.55	.55	.....	Open shop. No agreements.
Chicago, Ill.	1.25	1.25	1.30	.82½*	.82½*	1.25	Closed shop most trades. Open shop *.
Cincinnati, Ohio	1.10	1.25	1.12½	.50	.87½	1.02½	Closed shop. Agreements expire 12/23/1923.
Cleveland, Ohio	1.25	1.25	.....	.87½	.87½	1.12½	Closed shop. Agreements expire 3/1/1923.
Columbus, Ohio	1.00	1.37½	1.00	35–.40	.80	.93	Open shop. No agreements.
Dallas, Texas	1.12½	1.25	1.37½	.35–.50	.50	1.10	Open shop.
Davenport, Clinton, Ia.	1.12½	1.00	1.00	.40	.75	1.12½	Closed shop. Agreements expire 5/1/1924.
Dayton, Ohio	1.15	1.25	.95	.40–.45	.40–.45	.....	Closed shop. Agreements expire 12/31/1923.
Denver, Colo.	1.18¾	.....	1.12½	.50	.75–.80	.....	Open shop.
Des Moines, Ia.	1.25	.90	1.00	.65	.87½	1.25	Closed shop, except electrician. Agreements expire 4/1/1924.
Detroit, Mich.	1.00–1.25	1.12½	1.12½	.50–.60	.90	1.00	Open shop.
Duluth, Minn.	.87½	.87½	1.10	.45–.60	.45–.60	.87½	Open shop. Maximum rates.
Elizabeth, N. J.	1.25	.....	.....	.55–.70	.87½	.....	Open. Agreements expire on 90 days' notice.
El Paso, Texas	1.25	1.12½	1.12½	.25	.25–.40	.....	Open shop most trades.
Erie, Pa.	.87½	1.10	1.12½	.50	.55	.80	Open shop, except bricklayer, plasterer, plumber.
Fall River, Mass.	.85–.90	1.12½	.....	.50–.60	.60–.70	.80–.90	Open shop.
Flint, Mich.	.90	.90	1.12½	.50	.70	.....	Open shop.
Fort Wayne, Ind.	.80–.90	1.00	1.00	.40–.50	.65	.....	Open shop. No agreements.

Fort Worth, Texas	.75–1.12½	1.37½	1.37½	.25–.37½	.37½	.....	Open shop.
Grand Rapids, Mich	.90–1.00	1.12½	1.12½	.50	.50–.60	.....	Open shop.
Hartford, Conn	.90	1.00	1.00–1.12½	.50–.60	.60–.75	1.00	Open shop.
Houston, Galveston, Tex	1.25	1.00	1.12½	.30–.35	.75	1.00	Closed. Electrician, plasterer, hod carrier sheet metal in Galveston $1 day less.
Indianapolis, Ind	1.22½	.....	1.12½	35–.45	.75	.90	Closed shop except roofer, laborers. Agreements expire 4/1/1923.
Jacksonville, Fla	1.12½	.60–.90	.50–.60	.20–.30	.35–.40	1.12½	Open shop.
Jersey City, Hoboken, Bayonne, N. J.	1.25	1.25	1.25	.62½	.87½	1.25	Closed shop.
Kansas City, Mo	1.25	1.00	1.12½	.70	.90	1.00	Closed shop. Unsettled.
Knoxville, Tenn	.....	.....	.....	.25–.40	.25–.40	.....	Plasterer, painter, sheet metal, carpenter, laborers. Open shop.
Lawrence, Mass	1.05	1.00	1.12½	.65	.65	1.05	Closed shop.
Little Rock, Ark	1.12½	1.00	.90–1.00	.30	.40	1.00–1.25	Open shop.
Los Angeles, Pasadena, Cal	1.12½	1.00	1.25	.40–.50	1.12½	1.00	Open shop. No agreements.
Louisville, Ky	1.06¼	.....	1.00	.35–.50	.80	1.00	Closed shop.
Lowell, Mass	1.10	.....	1.12½	.50	.80–.90	1.00	Closed shop.
Lynn, Mass	1.12½	1.00	.....	.75	.75	1.12½	Closed shop.
Manchester, N. H	1.00	1.00	.....	.50	.65–.75	.90–1.00	Open shop. No agreements.
Memphis, Tenn	1.12½	1.25	1.25	.25	.62½	1.05	Open shop most trades.
Milwaukee, Wis	1.06¼	1.06¼	1.12½	.50–.75	.80	.60–.85	Open shop.
Minneapolis, Minn	.87½	.87½	1.00	.45	.55	.....	Open shop.
Montreal, Can	.75	1.00	.65	.35–.40	.45	.67½	Closed shop except roofer, laborer.
Nashville, Tenn	1.00	.90–1.00	87½	.30–.40	.40	.50–.60	Open shop most trades.
Newark, N. J., Orange, N. J	1.12½	1.25	1.25	50–.75	.87½	1.12½	Closed shop. Agreements expire 4/1/1923.
New Bedford, Mass	1.00	1.25	1.25	.50–.60	.75	1.00	Open shop most trades. No agreements.
New Haven, Conn	1.00	1.12½	1.12½	.50	.60	.....	Open shop most trades.
New Orleans, La	.90	1.00	1.00	.45	.65	.56¼	Closed shop.
New York, N. Y	1.12½	1.12½	1.12½	.87½	1.00	1.12½	Closed shop.
Norfolk, Va	1.00	1.00	1.12½	.30–.35	.50–.60	.90	Open shop most trades. No agreements.
Oakland, Berkeley, Cal	1.12½	1.00	1.06¼	.56¼–.62½	.81¼	.87½	Open shop.
Oklahoma City, Okla	1.00	1.25	1.12½	.40	.65	.80	Open shop.
Omaha, Neb	1.12½	1.00	1.12½	.40	.50	.....	Open shop. No agreements.
Ottawa, Can	.80	.85	1.00	.45	.45–.50	.80	Closed shop. Agreements expire 5/1/1924.
Paterson, N. J	1.25	.....	1.12½	.55–.75	.87½	1.12½	Closed shop except painter, laborer. Agreements expire 5/1/1924.
Peroia, Ill	1.12½	1.25	1.12½	.67½	.67½	1.12½	Closed shop. Agreements expire 4/1/1924.
Philadelphia, Pa., Camden, N. J	1.00	1.12½	1.12½	.45–.50	1.00	.90	Open shop.
Pittsburgh, Pa., Allegheny, Pa	1.25	1.25	1.25	.70	1.00	1.12½	Closed shop. Agreements expire 2/28/1924.

BUILDING TRADES WAGES, PER HOUR, IN ALL OF THE PRINCIPAL CITIES.—(*Continued*)

City	Steam fitter	Stone cutter	Tile setter	Laborer	Hod carrier	Pipe coverer	Notes
Portland, Ore.	$1.12½	.....	$1.25	.50–.70	$1.00	$ 1.12½	Closed shop.
Providence, R. I.	1.00	1.00	1.15	.55	.60	1 00	Closed shop.
Reading, Pa.	1.00	1.00	1.00	.45–.50	.90	1.00	Open shop.
Richmond, Va.	.87½	1.25	1.00	.35	.60	.85	Open shop.
Rochester, N. Y.	1.05	1.12½	1.12½	.60	.65	1.00	Closed shop, except engineers, laborers. Agreements expire 4/1/1924.
Rockford, Ill.	1.25	1.02½	1.00	.55–.75	.55–.75	.75	Open shop.
Rock Island, Ill., Moline, Ill.	1.12½	1 00	1 00	.40	.75	1.12½	Closed shop. Agreements expire 5/1/1924.
San Antonio, Texas	1.12½	1.00–1.12½	1 12½	.25–.32	.37½–.42	.....	Open shop. No agreements.
San Diego, Cal.	.....	.....	1.00	.40–.60	.87½–1.00	1.00	Open shop.
San Francisco, Cal.	1.12½	1.00	1.06¼	.56–.62	.81¼	.87½	Open shop. Unsettled. Agreements expire 1/1/1923.
Salt Lake and Ogden, Utah.	1.12½	1.12½	1 00	.50	.87½	1.00	Open shop. No agreements.
Savannah, Ga.	1.00	1.00	1.00	.20	.20	.....	Open shop.
Seattle, Wash.	1.12½	1.00–1.12½	1.25 1.37½	.50–.62½	.62½–.80	.....	Open shop. Agreements expire 5/1/1924.
Schenectady, N. Y.	1.10	1.12½	1.12½	.50–.60	.62½	1.10	Closed. No agreement except carpenter painter.
Scranton, Pa.	1.00	1.10	1.50	.55	.65	1.00	Closed shop.
Shreveport, La.	1.25	1.25	1.37½	.35	.50	.....	Open shop most trades.
Sioux City, Ia.	1.00	.....	.80	.40–.50	.50	.....	Open shop most trades.
Spokane, Wash.	1.00	1.25	1 00	.62½	.75	.90	Close shop most trades. No agreements.
Springfield, Holyoke, Mass.	1 00	1.12½	1 15	.35–.65	.87½	1.00	Closed shop most trades.
St. Joseph, Mo.	1.25	1.25	1.25	.40–.60	.40–.60	.80	Open shop most trades. No agreements.
St. Louis, Mo., E. St. Louis, Ill.	1.25	1.25	1 25	.67½–.80	1.00	1.15	Closed shop. Agreements expire 3/1/1924.
St. Paul, Minn.	.87½	1.12½	1.12½	.40–.50	.55–.71½	.85	Open shop. Maximum rates.
Syracuse, N. Y.	1.05	1.00	1.12½	.65	.65	.....	Closed shop. Most agreements expire 12/31/1923.
Tacoma, Wash.	1.12½	.....	1.25	45–50	1.12½	.....	Open shop.
Toledo, Ohio	1.12½	1.12½	1.25	.40–.45	.87½	1.12½	Open shop. No agreements.
Toronto, Can.	.90	1.00	1.00	.45–.55	.65	.90	Open shop most trades.
Trenton, N. J.	1.12½	1.25	1.12¼	.55	.75	1.25	Closed shop. Most agreements expire 12/31/1923.
Troy, N. Y.	1.00	.....	1.12½	.45–.50	.50–.70	.....	Closed shop most trades.

Utica, N. Y.	1.00	.....	1.12½	.65	.65	.....	Open shop except bricklayer, plasterer, electrician.
Vancouver, B. C.	1.00	1.06¼	1.06¼	.50	.56¼	.62½	Open shop. No agreements.
Washington, D. C.	1.12½	1.12½	1.12½	.45–.65	.62½–.75	1.00	Closed shop. No agreements.
Waterbury, Conn.	1.00	1.12½	1.12½	.40–.60	.50–.60	1.00	Open shop.
Wheeling, W. Va.	.90	.....	1.12½	.45	.45	.90	Open shop.
Wilmington, Del.	1.00	1.12½	1.12½	.45–.50	.75	.....	Open shop.
Winnipeg, Man.	.90	.95–1.07½	1.00	.42½–.50	.50–.55	.80	
Worcester, Mass.	1.00	1.00	1.12½	.55	.90	1.00	Open shop most trades.
Youngstown, Ohio	1.00	1.25	1.12½	.50–.60	.80	1.00	Closed shop.

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CHAPTER II

EXCAVATION

Excavation consists of the following operations:

Loosening the material
Loading for removal
Hauling
Dumping.

The estimator should visit the site to ascertain the kind of material to be excavated, whether it is of loam, clay, hardpan or rock. The labor required will vary depending on the condition of the soil and the possibility of striking rock or water.

In estimating the volume of the excavation, the dimensions should be taken the required distance beyond the walls to include the footings, and, in case of loose soil, the additional amount of material which must be removed when the banks have to be sloped. In loosening the soil its bulk increases about 25 per cent, for which an allowance must be made in estimating handling and hauling.

Loosening of material may be done by pick and shovel, team and plow, drag scrapers, or by steam shovel.

Pick and Shovel Method.—For excavations which do not warrant the installation of a steam shovel, the pick and shovel method is commonly used. The labor required for this class of work is shown in the following table. Each kind of work specified is given for three kinds of soil; first "Light Loam or Sand," which includes any soil that can be shoveled with little or no picking; second," Heavy Loam or Medium Clay," which includes soils that are easily loosened by pick and handled by shovels without much difficulty; third, "Hardpan or Cemented Gravel," which includes those that can be loosened only by difficult picking or are of such a sticky nature that the shoveling is slow and expensive. The work is again divided for conditions of the soil, whether wet or dry. All soils are considered dry when it is not necessary to do considerable pumping and bailing, or to sheet

pile in order to keep out the water. The column "Team Haul" is intended to include a man and a team. Where the haul is for a

EXCAVATION OF SMALL CELLARS AND TRENCHES
Pick and Shovel Method

Kind of work	Kind of soil	Kind of soil	Hours per cu. yd. common labor			
			Excavation	Backfill	Total	Team haul under 500 ft.
Cellars not over 8 ft. deep, loading in dump wagons.	Dry	Light loam or sand	0.92	....	0.92	0.25
	Dry	Heavy loam or medium clay	1.55	....	1.55	0.25
	Dry	Hardpan or cemented gravel	2.18	....	2.18	0.25
	Wet	Light loam or sand	1.50	....	1.50	0.25
	Wet	Heavy loam or medium clay	2.40	....	2.40	0.25
	Wet	Hardpan or cement gravel	3.43	....	3.43	0.25
Cellars not over 8 ft. deep, wheeling not over 100 ft.	Dry	Light loam or sand	1.60	....	1.60	
	Dry	Heavy loam or medium clay	2.11	....	2.11	
	Dry	Hardpan or cemented gravel	2.96	....	2.96	
	Wet	Light loam or sand	2.11	....	2.11	
	Wet	Heavy loam or medium clay	2.86	....	2.86	
	Wet	Hardpan or cement gravel	4.21	....	4.21	
Trenches not over 6 ft. deep, throwing to one side.	Dry	Light loam or sand	1.19	0.79	1.98	
	Dry	Heavy loam or medium clay	1.63	0.83	2.46	
	Dry	Hardpan or cemented gravel	2.58	1.00	3.58	
	Wet	Light loam or sand	1.54	0.79	2.33	
	Wet	Heavy loam or medium clay	2.16	0.83	2.99	
	Wet	Hardpan or cement gravel	3.64	1.00	4.64	
Trenches 6 ft. to 11 ft. deep, throwing to one side.	Dry	Light loam or sand	1.90	0.79	2.69	
	Dry	Heavy loam or medium clay	2.22	0.83	3.05	
	Dry	Hardpan or cemented gravel	3.64	1.00	4.64	
	Wet	Light loam or sand	2.58	0.79	3.37	
	Wet	Heavy loam or medium clay	2.86	0.83	3.69	
	Wet	Hardpan or cement gravel	5.00	1.00	6.00	
Trenches 11 ft. to 16 ft. deep, throwing to one side.	Dry	Light loam or sand	2.86	0.79	3.65	
	Dry	Heavy loam or medium clay	3.33	0.83	4.16	
	Dry	Hardpan or cemented gravel	5.00	1.00	6.00	
	Wet	Light loam or sand	3.80	0.79	4.59	
	Wet	Heavy loam or medium clay	4.44	0.83	5.27	
	Wet	Hardpan or cement gravel	7.27	1.00	8.27	

distance greater than 500 ft., the cost can be figured on the assumption that a dump wagon holds 1½ cu. yd., and that a team will walk about two miles per hour. Therefore, the time required to haul 1 cu. yd. one mile would be 0.67 hr. For each additional thousand feet haul the time would be 0.125 hr.

SHEET PILING FOR SMALL CELLARS AND TRENCHES

Kind of work	Unit of work	No. of hours carpentry	M.B.F. of lumber
Cellar not over 8 ft. deep	100 S. F.	6.90	0.15
Both sides trenches, 10 ft. deep, 2 in. by 10 ft. long	100 L. F.	46.00	3.00
Both sides trenches, 14 ft. deep, 2 in. by 14 ft. long	100 L. F.	62.00	4.20

The labor as given in the table above is for average work and the hours specified are for one carpenter, assuming, however, that two or more carpenters work together where more than one man is needed to do the work economically. The amount of lumber specified for sheet piling is based on the use of 2 in. plus an allowance of 50 per cent for string pieces, bracing, etc. It is also assumed that the lumber is used twice. If, for any reason, it can be used only once, then the amount of lumber shown in the table should be doubled, and if used more than twice, a corresponding reduction can be made. The cost of the work has not been carried out as the prices of labor and of material vary so much for different sections of the country.

Team and Plow Method.—Two men with team and plow will loosen 40 to 60 cu. yds. of loam or 25 to 30 cu. yd. of heavy soil per hour.

Drag Scrapers.—Drag scrapers are made in three sizes with a rated capacity of 3, 5 and 7 cu. ft. As scrapers are seldom filled to capacity only about 75 per cent of the rated capacity should be figured. Scrapers can be used only for sand, light or loosened soils. A team and scraper will move 4 cu. yd. of soil a distance of 100 ft. per hour.

Steam Shovel Work.—It is usually more economical to handle large jobs with a steam shovel. This work is frequently sublet by the general contractor to an excavating contractor who specializes in this class of work but many general contractors find it advantageous to have their own shovel.

STEAM SHOVEL DATA

(Courtesy of Erie Steam Shovel Company)

	Unit	Type *A*	Type *B*
Capacity of dipper	C.Y.	½	¾
Approximate weight with traction wheels	Tons	13	19
Rated capacity per hour—deep cut	C.Y.	30 to 40	50 to 60
Rated capacity per hour—shallow cut	C.Y.	15 to 25	25 to 35
Width of floor level cut	Feet	28 in.–4 ft.	32 in.–8 ft.
Width of dump	Feet	40 in.–4 ft.	45 in.–4 ft.
Height of dump	Feet	12 in.–11 ft.	13 in.–8 ft.
Approximate price f.o.b. factory, on traction wheels		$6,250	$7,200
Approximate price f.o.b. factory, on caterpillar mounting		$7,750	$9,000

These shovels are easily converted to operate as cranes, dragline excavators, pile drivers, steam hoes, and railway ditchers. They can be mounted on car wheels, traction wheels or caterpillar trucks.

Type *A*, ½-cu. yd. shovel, on ordinary clay or loam will handle from 200 to 400 cu. yd. per day of 10 hrs. Type *B*, ¾-cu. yd. shovel, will handle, of the same kind of material, from 400 to 600 cu. yd. per day. This, of course, is under favorable conditions and on the assumption that there are enough teams or auto trucks supplied so that the shovel will not be kept idle.

The cost of running a steam shovel includes the following: fuel and water, waste and upkeep, repairs, depreciation, moving from job to job, and interest on investment.

The crew consists of an operator, a fireman, and usually two pitmen.

Fuel and Supplies. -A type *A* shovel will consume 1,000 lb. of coal and 1,000 gal. of water when operated to capacity during a 10-hr. day. A type *B* shovel will consume 1,500 lb. of coal and 1,500 gal. of water per day.

Upkeep and Repairs.—Oil, waste, upkeep, and repairs will cost approximately $2 per day.

Depreciation.—The life of a steam shovel like that of any other machine depends largely on how it is cared for, but the manufacturers estimate the life to be 2,000 working days, which would amount to from $3 to $4 per day of use.

Interest on Investment.—If the cost of the shovel is $6,500 it is easy to figure the annual interest which at 6 per cent would be $390, but to change this to a price per day of use is not so easy. If the shovel is used but 30 days in the year, the rate would be $13 per day, but if used 200 days, $1.95 per day. Assuming an average of 100 days' use, the cost would be $4 per day.

Cost of Moving from Job to Job.—Estimating the cost of moving the shovel is even more uncertain than the item of interest, but this becomes easier when the actual conditions are known. When the distance is only a few miles, a shovel mounted on traction wheels will travel under its own power about ¾ of a mile per hour and at a cost of about the same as that of operating the shovel for the same length of time. It is usually more economical, however, to tow the shovel with a 5-ton truck. When it is necessary to ship a shovel by train, either of the shovels described can be shipped on a single flat car, but they usually have to be removed from their trucks. If a crane is available, loading is comparatively a simple matter, although there is still considerable blocking to be done. The expense in this case will consist of one day's time for two men and $35 for blocking. If, however, the loading is by hand, it will require a gang of five men for one day and the same expense for blocking. Some contractors allow $100 for the cost of loading and handling under average conditions. Of course freight must be added to the above.

Hauling.—The cost of team or trucks is a variable quantity and the estimator should obtain local rates. Motor trucks are usually used in hauling material excavated by steam shovels and their capacity is 3, 5 and 7 cu. yd. A ¾-yd. steam shovel should excavate and load into trucks from 250 to 300 cu. yd. in a 9-hr. day. The present rates for motor trucks run from $22.50 to $30 for a 9-hr. day.

The average charge for a two-horse cart is from $11 to $13 per day and sometimes as high as $15. The capacity of the trucks available for a job should be ascertained before estimating the cost of hauling. The average loading time for a steam shovel is about 10 min. which includes waiting time, the dumping time about 5 min. and the time required to haul from job to dump may be computed by assuming an average speed of from 8 to 10 miles an hour for truck, depending on the conditions of the roads.

CHAPTER III

FOUNDATIONS

In designing and estimating a building one of the first things to be determined is the character of the foundations. If the structure to be supported is light or of a character which will not be seriously affected by settlement, no particular investigations are necessary, since spread footings can usually be installed to meet these conditions as the work proceeds.

Simple Foundations.—When the foundations do not go down too deep and when the soil is firm, it is often possible to excavate for a wall trench or column foundation in such a way that forms for the bottom or footing course are not required, but the concrete may be poured directly into the trench, thus starting the form work at the top of the footing course. When this method can be followed it effects quite a saving, both in the excavation and the form work. If, however, space is required outside the walls to afford the waterproofers room to work, this method cannot be employed.

Battered and Stepped Footings.—It seldom pays to batter column foundations for small or medium sized piers, as the saving in concrete is more than offset by the extra cost of forms. They can either be carried up full size or stepped back thus using but little more concrete than would be necessary for battered piers, and the forms can be constructed in half the time with considerable saving.

Anyone wishing to go into the theory of stepped and spread footings, will find the subject fully covered in such books as Hool and Johnson or Kidder-Nolan. The estimating of quantities and costs of such work is however comparatively easy. It usually pays from the contractor's standpoint to make the formwork as simple as possible, even to filling in frequently with concrete odd spaces where not strictly required, rather than to save the concrete by the construction of additional formwork. To decide theoretically the amount to step back each footing course, requires considerable calculation

together with a knowledge of the strength of the concrete. A rule of thumb method which is often followed and which in most cases errs on the side of safety, is to step back each course by one-half its depth, *i.e.* for a 12-in. course, the offset would be 6 in. When it is desirable to make the offset much more than this, it is best to resort to reinforcing or grillage beams.

Special Foundations.—If the structure is heavy and settlement would cause serious results, careful investigations should be made. It is often possible to secure reliable information regarding proposed foundations by ascertaining the conditions encountered on adjacent structures. If such information is not available or if there is any doubt as to its reliability, it is well to proceed as follows:

Test Pits.—The character of the soil should be determined to a depth below which noncompressible material is found. This can sometimes be done by digging test pits, but usually borings are more economical and reliable. The cost of putting down a test pit varies with the depth and the character of the material, and it is usually well to arrange with some local excavator to do this by day labor. If the area of the structure is large and incompressible material is not found within 10 or 15 ft. from the surface, it is usually desirable to put down some kind of a boring.

Wash Borings.—Wash borings are most commonly used and generally contractors can be found who specialize in this line and who will do the work on a price per foot basis. The ordinary cost of such borings is from 50 cts. to $1 a foot although these limits do not cover either very small jobs or very large ones. In making wash borings one should be careful to interpret intelligently the results obtained since the samples secured are often entirely different from the material actually penetrated due to the fact that the water used in making the borings washes out much of the silt. Unless an experienced wash boring contractor is obtainable, it is advisable to make borings in such a way that actual samples of the material penetrated will be secured in their natural condition.

Core Borings.—This can be done by making core borings. In material into which a pipe can be driven core borings can usually be made for from $1 to $2 per lineal foot. Actual samples of the material are obtained in their natural condition and should be preserved in glass jars so as to retain the original moisture content. Where hardpan or rock is found, it is necessary to make a core boring

with rock drills which ordinarily costs from $3 to $10 per lineal foot, depending on the depth and the character of the material to be penetrated.

Soil Tests.—If the material at the elevation of the foundations indicates that spread footings may be used and the borings show that there are no underlying strata of compressible material, soil tests should be made to determine the unit loading allowable for spread footings. The various building codes of the country limit the unit loading on the different materials but accurate determination of the soil under consideration can be made by applying test loads to the soil.

It is ordinarily desirable to test an area of at least 4 sq. ft. This is usually done by building a wooden block of this area. This block is then set on the original soil which has been carefully smoothed off at the foundation level and loaded with sand, pig iron, cement, bricks, or other available material which can be supported on a platform superimposed on the block. The safe value of the soil is usually considered to be one-half the unit load that will cause settlement of 1 in. although this limit may sometimes be exceeded if no settlement occurs under the first half of the loading. The approximate cost of testing 4 sq. ft. for a safe load of 4 tons or for a total test load of 32 tons is usually about $100.

If the borings and soil test indicate that the foundations must be designed for a unit load of less than 2 or 3 tons, or that the foundations must be extended more than 10 ft. below the level at which they can be placed in order to conform to the design of the building, the possibility of using other than spread footings should be investigated. The economy of the different types of foundations will depend entirely on local conditions, but with adequate borings available an experienced foundation engineer or contractor can give an intelligent estimate by the following methods:

Caissons.—If material capable of supporting the structure economically can be found within 10 ft. of the bottom of the foundations, open pits or caissons can usually be employed advantageously. Their cost depends largely on the amount of water which will be encountered and the sheeting which will be required to support the sides while the holes are being dug. The cost of sheeting such holes generally ranges between 20 and 50 cts. per square foot of sheeted area. The cost of excavation varies between $2 and $4 per

cubic yard, while the cost of pumping depends entirely on the amount required and no general figures can be given.

Gow Caissons.—The Charles R. Gow Company of Boston has developed a system of installing open caissons which can often be economically used where the material penetrated contains considerable water or the depth of firm material ranges from 10 to 40 ft. Steel cylinders of sufficient strength to withstand the lateral ground pressure are sunk by driving and excavating within them. The steel sections are from 4 to 12 ft. long, the lower sections being smaller in diameter than the upper sections. So as the caisson is excavated the diameter thus decreases at the rate of 1 in. per 8 ft. The minimum diameter of these piles, which is determined by the space in which a man can dig, is usually 3 ft. In many materials it is possible to bell out the base of the caisson so as to secure a larger bearing area than the diameter of the bottom of the pile. The cost of such piles varies from $20 to $40 a yard including the excavation, pumping, concrete and the use of the shells which eliminate sheeting. Detailed estimates on any given job may be obtained from this company.

Compressed Air Caissons.—It is sometimes desirable to carry caissons through material which cannot be excavated without being retained under compressed air. The cost of such work cannot be generally determined but contractors who specialize in this class of work would be glad to furnish estimates on any particular work. In general the applied cost of such caissons will be in excess of $40 per cubic yard.

Piling.—If firm material is not encountered within 10 ft. of the required foundation levels, the economy of using some sort of piling should be investigated. The different types of piling are in general as follows:

Wood Piles.—Wood piles can be used for permanent foundations where the water level will always remain above the heads of the piles. Where the water level is subject to tidal variations it is desirable to keep the wood piles below the low water level, although in some cases it is considered safe to cut them off at mean tide level. The elevation of ground water, or as it is sometimes called "the moist line," cannot ordinarily be depended upon as permanent since this will vary with the seasons and other conditions which often cause this elevation to fluctuate materially. If the water level drops below the heads of the wood piles so that they dry out, even for comparatively

short period, serious deterioration and ultimate failure are to be expected.

The unit loading on wood piles is given in the various building codes and ranges from a minimum of 8 tons to a maximum of 25 tons. Ordinarily a loading of 15 tons is considered safe.

The cost of wood piles is dependent on the size of the job and local conditions. An estimate from local contractors should be obtained wherever possible. For work requiring approximately 500 piles from 25 to 40 ft. long, the cost will vary from 30 to 50 cts. a foot for the completed pile including the material, placing and cutting off. Since transportation figures largely in the cost of wood piles, the total cost would be least where wood piles are available close to the site of the work. Piles over 50 ft. in length must usually be secured from the southern states so that the cost of such piles may be considerably greater. A unit price of 50 cts. a foot for piles in place up to 60 ft. long can however generally be obtained.

Concrete Piles.—Since concrete piles are not affected by moisture they can often be economically used where the foundations to be supported are above permanent water level, thus rendering unnecessary the additional cost of carrying the foundations down to water level. Concrete piles will support loads considerably in excess of those carried by wood piles since they are ordinarily of greater size and in many cases can be driven to a firmer bearing due to their greater structural strength.

Raymond Concrete Piles.—On land foundation work a widely used form of concrete piles is that installed by the Raymond Concrete Pile Company which maintains offices in most of the principal cities of the United States, and who may be called on for estimates on any particular work. These piles are formed by driving a steel mandrel encased in a steel shell. After the mandrel and shell have been driven to the required penetration the mandrel is withdrawn and the shell inspected and filled with concrete. The shell is of sufficient strength to withstand the soil pressure and remains in the ground as a permanent protection for the concrete. If inspection, which is usually accomplished by lowering a light into the driven shell, indicates that the shell has been torn or otherwise damaged or that it contains water, these defects are remedied by driving another shell inside the defective one. The point diameter of these piles is usually 8 in. The diameter

increases with the length at the rate of 0.4 in. per lineal foot of pile so that for a 30-ft. pile the head diameter is 20 in. For short piles driven to rock a point diameter of 11 in. is provided. Under most conditions a safe load of 30 tons each can be developed on these piles. The cost of such piles varies with the size of the work and the conditions encountered, but for ordinary conditions in 500-pile units about 20 ft. long, the cost ranges from $1.50 to $2.25 per lineal foot for the completed pile driven and cut off.

These piles are ordinarily spaced on 2-ft. 6-in. centers where the head diameter does not exceed 20 in. For larger head diameters, which are required where the piles exceed 30 ft. in length, a spacing of 3 ft. is ordinarily used. This pile is known under the general classification as a "cast-in-place" pile since the pile is built in the ground.

Mac Arthur Piles.—Cast-in-place piles are also installed by the Mac Arthur Concrete Pile Company of New York and under the Simplex system by various licensees throughout the country. The piles obtained by these two systems are similar in character although the method of installation varies somewhat. In driving Mac Arthur piles, which are sometimes called "pedestal" piles, an open ended steel pipe together with a steel core or ram which fills the pipe is driven to the required penetration. The core is withdrawn and the pipe filled with concrete. In some cases after a portion of the concrete is placed in the pile it is forced into the surrounding material by driving the concrete out of the pipe with the ram. As soon as the pipe has been filled to the surface with concrete the pipe is withdrawn. As the pipe is withdrawn the weight of the ram and hammer is allowed to rest on the concrete to prevent its sticking to the inside of the pipe.

Simplex Piles.—Under the Simplex system a pipe with a detachable cast steel point is driven to the required penetration and filled with concrete. The pipe is then immediately withdrawn leaving the point in the ground. If the concrete adheres to the inside of the pipe while it is being withdrawn it is loosened by repeatedly dropping a plumb bob weighing 200 to 300 lb. on the green concrete inside the pipe.

Time Required to Drive Piles.—On ordinary work from 20 to 50 Raymond concrete piles can be driven in 8 hrs. with one machine, while the rate of placing Mac Arthur or Simplex piles is usually from 10 to 20 piles per day. It usually requires about two weeks' time to move a pile driver to the work and set it up ready to drive. One

cannot count on more than 4½ working days per week. This allows one day for weather in which piles cannot be driven. Cold does not prevent the driving of cast-in-place piles but rain makes it unsafe to move the heavy equipment required for their installation.

Steel Tube Piles.—Steel tube piles, otherwise known as "Hercules Piles" are sometimes used where conditions are favorable. These piles consist of a steel pipe with a wall thickness of from ¼ to ¾ in. This is driven to rock and then cleaned out and filled with concrete. Compressed air is commonly used to clean out the pipes. This is done by means of 3 or 4-in. air jets with suitable nozzles which are forced into the material enclosed in the pipe after it has been driven. The force of the air used must be sufficient to blow the material out. This generally requires from 100 to 150 lb. per square inch pressure. Water jets are sometimes required where the enclosed material is very firm. If sufficient care is used in driving and cleaning out the pipes a perfect column can be secured resting on bed rock that is capable of supporting large loads. The permissible supporting power of these piles is usually determined by local building codes and varies with the diameter of the pipe and with the thickness of the steel shell. The usual loading of such piles varies between 60 and 100 tons.

The cost of completed piles of this type varies from $5 to $15 a foot. On average work the price should be between $6 and $7 a foot for piles up to 14 in. in diameter with ⅜-in. steel walls.

Where piles are in excess of 20 ft. in length it is necessary to splice the pipes and this is done by using inside cast-steel sleeves. The number of joints allowed together with the ratio of the pile length to the allowable diameter are also usually determined in the building codes. Where boulders are found in the soil or where the pipes must be driven through heavy gravel it is very difficult to get the piles down to bed rock and great care should be exercised to avoid stopping these piles on loose stones which would materially reduce their bearing value. It is also difficult to clean out pipe piles properly with a length in excess of 40 ft. and while longer piles have been satisfactorily driven they are not ordinarily used.

Pre-test Piles.—Pre-test piles driven by the Spencer, White & Prentis Company of New York are also advantageous in some cases, although this type of construction is usually confined to underpinning work. These piles consist of short sections of steel shells

which are filled with concrete as placed and are jacked down below the foundations to be supported using the building itself as a reaction for the jacks. The first section of filled pipe is placed in the excavation below the foundation. After the section has been jacked into the ground sufficiently the jack is removed and another section of pipe filled with concrete is superimposed on the first section and again jacked into the ground. When sufficient resistance to sustain the designed load is indicated by the pressure on the jacks the load is transmitted from the pipe pile to the foundation by means of vertical steel beams and wedges which retain the pressure generated by the jacks. Hydraulic jacks with from 30 to 100-tons capacity are employed in this work. The price of these piles varies so greatly with the character of the work that no general figures can be given although this company will give estimates on any particular work.

Pre-cast Concrete Piles.—Pre-cast concrete piles have been extensively used for many years and are particularly economical for use on dock and water front construction where they are usually placed with floating equipment. Piles in excess of 100 ft. in length have been successfully driven although the usual lengths vary from 20 to 75 ft. These piles must be properly reinforced to withstand the strain of lifting them from the casting platforms and placing them in the pile driver leads. They must be designed to withstand driving. Most pre-cast piles are placed with the aid of water jets thus materially reducing the driving strain. The size of these piles varies with the design of the structure and load to be supported, as well as with the length. They are seldom less than 12 in. or more than 20 in. square.

The average cost of the completed pile in place is approximately $3 a foot, although this figure is in many cases exceeded and in some cases where large numbers are required a price of as low as $2 a foot may be secured. On any particular work in question an estimate should be secured from contractors skilled in this class of work as any general assumptions are apt to be erroneous. The use of pre-cast piles for land foundations is not ordinarily economical. It is usually costly to use adequate jetting equipment away from the water front and without jetting the pre-cast piles are apt to be injured in driving.

It is also very difficult to predetermine the length of pile required, which must be done before the piles can be cast. The actual penetration of the piles usually varies considerably from the predetermined length unless extensive jetting is done, so that the piles cast will

usually be too long or too short. If they are too short additional piles must be cast or the foundation caps lowered, and if they are too long the pile must be cut off and the unused portion wasted. In either event the cost of the work is materially increased beyond the original estimate so that where concrete piles are desirable on land foundation work cast-in-place piles usually prove more economical.

It ordinarily requires at least two weeks to set up the equipment to prepare for casting piles. After they have been cast they should be allowed to cure for at least 30 days so that 6 weeks must ordinarily elapse before actual pile driving can commence. The rate of progress of driving pre-cast piles is about 10 piles per driver per shift.

CHAPTER IV

WATERPROOFING AND DAMPPROOFING

Integral Waterproofing Compounds.—The standard Integral Waterproofing Compounds are manufactured in four forms: powder, paste, liquid and metallic. The specifications for their use are practically all based on a variation of from 1½ to 2 per cent of the cement used.

The Powder Waterproofings are usually used in the proportion of 2 lb. of powder to each bag of cement or 8 lb. per barrel. If the concrete is to be mixed by hand the powder should be added directly to the dry cement and mixed until the powder is uniformly distributed throughout the cement before incorporating the aggregate. When a concrete mixer is used, the powder should be added directly to the cement at the hopper or on the loader. The time of mixing should be sufficient to insure uniformity throughout the mass.

The Pastes are used in the proportion of 1 to 17 with the mixing water in cement mortars and 1 to 34 with the mixing water for concrete. This is about 1 to 1½ per cent. The use of the smaller percentage of paste is permissible because it mixes with the water better than do the powders.

The Liquid Waterproofings are used in the proportion of 1 to 12 with the mixing water. They weigh 10 lb. to the gallon. Therefore, one-half gallon is used to a bag of cement. This is 5 per cent of the cement, or 5 lb. per bag.

The Metallic Waterproofing system consists of brushing finely divided iron in conjunction with sal ammoniac on the inner face of walls, thus building up an iron oxide. Prices are usually given for the material installed.

POWDER MATERIALS

Trade name	Manufactured by	Average price per pound
Hydratite Powder	A. C. Horn Company	$ 0.10
Medusa Waterproofing	Sandusky Portland Cement Company	0.10
GF-11	General Fireproofing Company	0.10
Toxement	Toch Brothers	
Truscon Waterproofing Powder	Truscon Laboratories	0.10
Integral	Integral Waterproofing Company	0.08

PASTE WATERPROOFINGS

Hydratite Paste	A. C. Horn Company	0.10
Medusa Waterproofing	Sandusky Portland Cement Company	0.10
Toxement Paste	Toch Brothers	0.10
GF-10	General Fireproofing Company	0.10
Truscon Waterproofing Paste	Truscon Laboratories	0.10
Ceresit Waterproofing	Ceresit Company	0.10

LIQUID INTEGRAL WATERPROOFINGS

Trade name	Manufactured by	
Anti-hydro	Anti-hydro Company	$1.25 per gal.

METALLIC WATERPROOFINGS

Ironite	Ironite
Metallic Waterproofing	Western Waterproofing Company

Interior Dampproofing.—There are two types of Interior Dampproofing. One is the Brush Coating and the other the Trowel Coating.

The best known materials of the Brush Coating are:

TRADE NAME	MANUFACTURED BY
Dehydratine No. 1	A. C. Horn Company
R. I. W. No. 232	Toch Brothers
Hydrocide	Sonneborn Sons, Inc.
Hydronon	Barrett Company

Antihydring	Antihydring Company
Plasterbond	Truscon Company
GF-200	General Fireproofing Company
Elaterite	Des Moines Elaterite Company

The covering capacity of the Brush Coating on common brick wall is about 35 sq. ft. for two-coat work and 60 sq. ft. for one-coat per gallon. Two-coat work is generally recommended for any dampproofing. This material must never be regarded as an aid or bond for plaster and under no circumstances must it ever be used where plaster is applied over concrete. It should not be used on ceilings that are to be plastered or where a cement mortar is used on either side of the dampproof coating. The material should be applied with a four-knot roof brush, preferably one with a long handle. One man can apply 35 gal. a day. The average price for this material throughout the country is about 90 cts. a gallon. The cost of hoisting to any floor above the ground floor is 75 cts. a barrel.

The standard Trowel Coatings are:

Trade Name	Manufactured by
Plastertox	Toch Brothers
Dehydratine No. 10	A. C. Horn Company

One gallon will cover approximately 20 sq. ft., $\frac{1}{16}$ in. thick. The cost of hoisting is 75 cts. a barrel, as in the case of the first type, and a man will put on 500 sq. ft. a day. This material costs from 75 cts. to $1 per gallon f.o.b. factory.

Masonry Dampproofing.—These brush and plaster coatings are intended only for brick, stone and terra cotta walls, and not for concrete walls. They are applied on the inner face of exterior exposed walls and do not require furring, although in many instances they are used in conjunction with furring as an additional precaution. On tile surfaces where the tiles are well scored, the troweling compound cannot be used, but is thinned down in the proportion of 1 gal. of benzine to 5 gal. of the trowel coating, and then applied in a semi-plastic condition with a brush. The present market price of these materials by the barrel is 12 cts. per pound. A barrel weights 450 lb. net or 500 lb. gross.

Colorless Dampproofing.—The best known Colorless Dampproofings are;

Trade Name	Manufactured by
Dehydratine No. 2	A. C. Horn Company
Minwax	Minwax Company
Toxloxpores	Toch Brothers
Porseal	Truscon Company
Driwal	Billings-Chapin Company
GF-100 Colorless	General Fireproofing Company

The covering capacity of all these materials varies with the porosity of the surface to which they are applied, but the average covering capacity taken over all sorts of stone and brick is about 100 sq. ft. per gallon on one-coat work. The second coat will cover approximately 150 sq. ft., or one gallon covers 60 sq. ft. on two-coat work.

Ninety per cent of the leakage which occurs is caused by imperfections in the masonry work and the use of a colorless dampproofing is merely an additional factor of safety.

Pointing Walls before Dampproofing.—In figuring dampproofing for exterior work, consideration must be given to the "pointing up" which is much more essential than the colorless dampproofing. The caulking material should not be portland cement but should be a special caulking material, which is adaptable to pointing exceedingly small holes and hair cracks. A gallon of caulking material contains 231 cu. in. and generally this is sufficient for 2,000 sq. ft. of surface to be pointed. This material should be bought by the gallon and not on a pound basis, since the contractor is interested in bulk. Caulking material is worth $3 a gallon. Some of the caulking materials manufactured are:

Trade Name	Manufactured by
Vulcatex	A. C. Horn Company
Kuhl's Elastic Cement	Kuhl Company

An additional factor to be taken into consideration in dampproofing the exterior of a building is the caulking of the windows. A gallon of caulking material will caulk nine average sized windows.

Floor Hardeners.—There are three kinds of Floor Hardeners: Liquid Integral, Metallic, and Chemical.

These are recommended for use in the proportion of 1 to 10 with the mixing water. This will average 3 gal. per cubic yard of concrete or 1 to 2 gal. per 100 sq. ft. cement mortar, 1 in. thick of a 1 to 2 mix. They are also used as an anti-freeze in cold weather. The quantities will vary with the temperature.

LIQUID INTEGRAL HARDENERS

Representative kinds:		
Trade name	Manufactured by	Average price per gallon
Dehydratine No. 80	A. C. Horn Company	$0.80
Anti-Hydro	Anti-Hydro Company	1.25
Quickstone	Quickstone Company	0.80
Master Mix	Master Builders Company	0.80
GF-12	General Fireproofing Company	
Fermol	Sonneborn Sons, Inc	0.90
Viaraflux	Granitex Company	1.25

Metallic Floor Hardeners.—These are made in three colors—gray, red and green. The general level of prices is as follows: for the gray, 5 cts. a lb.; for the red, 8 cts. a lb.; and for the green, 20 cts. a lb.

The most common of these are:

TRADE NAME	MANUFACTURED BY
Ferr-Fax Metallic Hardener	A. C. Horn Company
Master Builders Metallic Hardener	Master Builders Company
Smooth-on Metallic Hardener	Smooth-on Cement Company
Truscon Metallic Hardener	Truscon Laboratories
GF-140	General Fireproofing Company
Ironite	Ironite Company

For light traffic, 15 lb. to the 100 sq. ft. applied as a dust coating, will prove sufficient. For heavy traffic 30 lb. should be used per 100 sq. ft.

Chemical Floor Hardeners. The most important of these are;

TRADE NAME	MANUFACTURED BY
Hornstone Crystals	A. C. Horn Company
Lapidolith	L. Sonneborn Sons, Inc.
Har-n-tyte	General Chemical Company
Agatex	Truscon Laboratories
GF-Crystalrox	General Fireproofing Company
Flintox	Toch Brothers
Saniseal	Master Builders Company
Granitol	Dustproof Floor Company
Whitex	White Company

These materials are known as Chemical Floor Hardeners, and are sold either in crystal or in liquid form. In the case of crystals, the specifications are that 1 lb. should be dissolved in a gallon of water for the first coat and 2 lb. per gallon for the second coat. Two pounds are calculated to cover 75 sq. ft. in two-coat work.

One man will cover 2,000 sq. ft. in a day. In estimating costs, it is best to allow for varying porosities by figuring only 60 sq. ft. as the covering capacity of 2 lb. of crystals. A gallon of the liquid (properly diluted) will have the same approximate covering capacity.

Cement Floor Fillers.—Representative kinds:

Trade Name	Manufactured by
Koncrex	A. C. Horn Company
Tilex	Dustproof Floor Company
Colorseal	Master Builders Company
Cement Filler Paint	L. Sonneborn Sons, Inc.
Cement Filler Paint	Minwax Company
Dustop	Toch Brothers
GF-155	General Fireproofing Company

The covering capacity of these materials will naturally vary with the porosity of the cement surfaces. They average approximately 5 gal. per 1,000 sq. ft. for the first coat and 3 gal. per 1,000 sq. ft. for the second coat. They can be applied with a long-handled brush at the rate of 2,000 sq. ft. per day.

BRUSH COATINGS FOR FOUNDATION WALLS BELOW GRADE

Representative kinds:

Trade Name	Manufactured by
Dehydratine	A. C. Horn Company
GF No. 16	General Fireproofing Company

The covering capacity of these materials is about 50 sq. ft. per gallon. The present market price is $1 per gallon in barrel lots, f.o.b. factory. A man can apply 1,200 sq. ft. in 8 hr., which makes a cost of approximately 3 cts. per square foot in place.

Basement walls are frequently coated with coal tar pitch. This pitch has to be heated and therefore requires the use of a kettle. The present market price is $30 per ton. A laborer can cover 1,100 sq. ft. on walls or 2,000 sq. ft. on floors in an 8-hr. day. The present price when done by contract is 3 cts. a square foot for floor work and 4 cts. a square foot on walls.

STAINPROOFING FOR CUT STONE WORK

The various stainproofings are all black, bituminous waterproof coatings. They are also acid proof. They are applied to the concealed parts of cut stone.

Representative kinds are;

Trade Name	Manufactured by
Dehydratine No. 3	A. C. Horn Company
R. I. W. No. 110	Toch Brothers
G. F. No. 14	General Fireproofing Company

One gallon will cover approximately 100 sq. ft. for two-coat work. The average price per gallon by the barrel f.o.b. factory is $1. A man can apply about 1,500 sq. ft. in an 8-hr. day. This work is usually done by the stone mason's helper on the job.

MEMBRANE WATERPROOFING

1-ply felt and pitch on walls	$0.05 sq. ft.
1-ply felt and pitch on floors	0.04 sq. ft.

A crew will apply in an 8-hr. day:

On walls	900 sq. ft.
On floors	1,750 sq. ft.
2-ply felt and pitch on walls	0.06 sq. ft.
2-ply felt and pitch on floors	0.05 sq. ft.

A crew will apply in an 8-hr. day:

On walls	750 sq. ft.
On floors	1,550 sq. ft.
3-ply felt and pitch on walls	0.07 sq. ft.
3-ply felt and pitch on floors	0.06 sq. ft.

A crew will apply in an 8-hr. day:

On walls	600 sq. ft.
On floors	1,300 sq. ft.
4-ply felt and pitch on walls	0.12 sq. ft.
4-ply felt and pitch on floors	0.10 sq. ft.

A crew will apply in an 8-hr. day:

On walls	450 sq. ft.
On floors	1,000 sq. ft.

MEMBRANE WATERPROOFING

5-ply felt and pitch on walls	$0.15 sq. ft.
5-ply felt and pitch on floors	0.12 sq. ft.

A crew will apply in an 8-hr. day:

On walls	350 sq. ft.
On floors	850 sq. ft.

A crew for waterproofing work consists of a foreman and two helpers. The present rate of wages in New York City is $9.50 per day for the foreman and $8.50 per day for helpers.

Material for Above.—A roll of felt contains 432 sq. ft.

WEIGHT OF FELT

14 lb. = 60.48 lb. to the roll
15 lb. = 64.80 lb. to the roll

The present market price of felt is $58.50 per ton f.o.b. factory.

The weight of one gallon of coal tar pitch is 10 lb. The cost is $30 per ton.

Material Required per 100 Sq. Ft. of Surface.

	ROLLS OF FELT	GALLONS OF PITCH
1-ply	0.25	7.5
2-ply	0.50	12.5
3-ply	0.75	16.0
4-ply	1.00	19.5
5-ply	1.25	22.5

CHAPTER V

REINFORCED CONCRETE CONSTRUCTION

Making the Estimate.—There does not seem to be any standard method of estimating concrete. Every contractor seems to have his own method of figuring quantities, doubling up on his quantities here or there for convenience and speed in getting out estimates, always with the mental note that the extra labor of doing this or that thing is thus compensated for. In some cases this is true, but in many cases it will be found that careful estimating of quantities often doubled, such as where a column passes through a floor slab, will reveal an allowance for material which in a large operation will pay many times over for the labor of fitting the floor form-panels around the column head.

There is no one "best" method, nor can unit costs be followed blindly. Behind every major item in the construction of a concrete building are numerous other items entering into and affecting its cost. The manner in which the firm is organized will determine how these items shall be segregated in the field for the benefit of the cost and estimating departments. This is also true for the class and the size of the work handled as well as for the extent of the timekeeper's duties, as affecting his ability to accurately record and classify time.

"A's" costs are generally useless to "B" unless both organizations follow the same cost-keeping methods; hence the danger of accepting and following blindly costs issued by others when the estimator is not thoroughly familiar with the details and means by which those costs were determined. While this applies to any costs, it is more than usually pertinent to concrete work. The numerous items which go to make up each division of the work may be separated or grouped in so many different ways that only by knowing just what is included in each classification of work can the costs made by one organization be of use to another. For this reason in the concrete section particular emphasis has been laid on methods of estimating rather than on

the costs themselves, except where it has been possible to give with the costs a full description of the make-up of that particular item. These methods of estimating presuppose a cost-keeping system capable of furnishing the estimator with the information he needs to judge probable unit costs.

The method of estimating that follows is suggested by Guy Deming. In considering the question of reliable practice in taking off quantities for concrete, it must be borne in mind that there is room for considerable divergence of opinion and opportunity for the exercise of judgment in individual cases. The practice followed was that in vogue in a large contracting firm that estimated a large number of concrete buildings in the course of a year, so that time-saving approximations were resorted to as long as they were on the safe side.

Assuming a complete set of drawings such as the better engineers and architects prepare, the procedure was usually as follows:

Footings—net quantities easily taken off accurately.

Walls—net quantities easily taken off accurately.

Columns—taken off by stories using floor to floor distances for heights. It is usually possible to combine the interior columns into relatively few groups, and exterior columns are usually uniform with the exception of corner columns.

Column Capitals (in the case of flat slab buildings). Compute a typical flared head about half way up the building and multiply by the total number. Tables make it easy to obtain the net volume, deducting the column shaft already figured.

Column Brackets—net quantities are easily computed.

Floors and Roofs—

A. Beam and girder construction.

1. The volume of the slab is the gross area times the thickness. Ordinary openings for stair and elevator wells are not deducted as no additions are made for extra beams or cost of forming around these openings.

2. Beams
   (*a*) Typical interior
   (*b*) Typical end span
   (*c*) Typical lintels

3. Girders
   As for beams

NOTE.—Beams and girder stems only are computed under 2 and 3, unless they are very heavy as in a flour milling building. The quantities at intersections are repeated without serious loss of accuracy when the grand total cost of the building is considered.

Floors and Roofs—

B. Flat Slab Construction

1. The slab as for *A* 1
2. Drop panels—net quantities are easily computed
3. Lintel beams

NOTE.—In estimating flat slab steel, it is usually easy and satisfactory to figure one typical interior panel, one typical wall panel and one typical corner panel, including the approximate number of each in the total for the floor.

C. The following applies to either beam and girder or flat slab construction:

1. Stairs. The following arbitrary rule has been used; to the total linear feet of riser (number of risers times width of stair) add one-half the area of the intermediate landings; multiply the sum by 0.75 to get the cubic feet of concrete and by 3.0 to get the pounds of steel.
2. Sills
3. Lintels
4. Mullions
5. Curbs
6. Belt courses
7. Cornices
8. Ornamentation
9. Coping.

The above items are cubed by multiplying the cross-section by the length. The cost of forms is estimated on the basis of linear feet for each item.

Summary.—A summary of the total concrete and steel is made without regard to the location except for floor finish which is computed in square feet of a given thickness and priced accordingly. Each class of form is summed and any unusual features noted for special attention. An allowance in pricing must be made for the extras charged for the smaller sizes of steel. Both flat slab and beams and girder floor forms are priced per square foot of floor area. The unit used absorbs the cost of beams and girders in one case and of drop panels and lintels in the other.

Forms.—In order to estimate accurately the amount of lumber entering into the various parts of the form system, or to make up the tables of lumber required per square foot of forms for various floor systems, the estimator must have clearly in mind the details which will be followed in building the forms in the field.

The following drawings and notes are taken from the book "How to Make Forms for Concrete Buildings," by Wm. F. Lockhardt, through the courtesy of the publishers of the magazine *Concrete*.

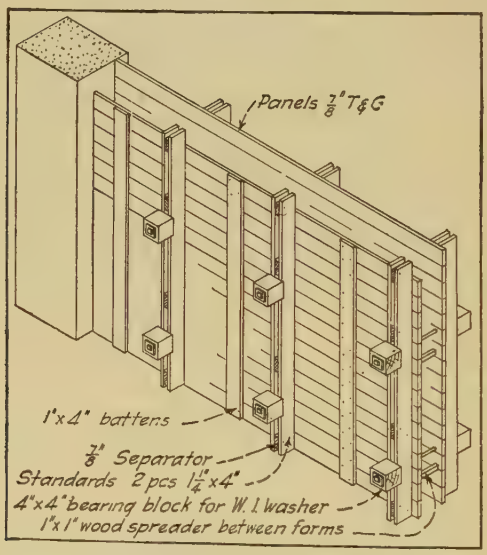


FIG. 1.—Wall construction without waling pieces.

Methods used for stripping and reposting will affect the quantity of lumber bought, so that it will be most convenient to consider the several phases of the work in turn, touching lumber sizes commonly used, with notes on safe carrying capacities, posting, stripping, and reshoring, form details and the lumber required.

The lumber must be strong enough to contain and support the concrete, and in the case of beam sides and floor panels, stiff enough to hold its lines after it has been made up into forms, without sagging or bulging, or requiring an undue amount of battening or bracing to keep it true. The

sizes given here have come to be accepted as standard by most large contractors, and for ordinary building work can be followed to advantage.

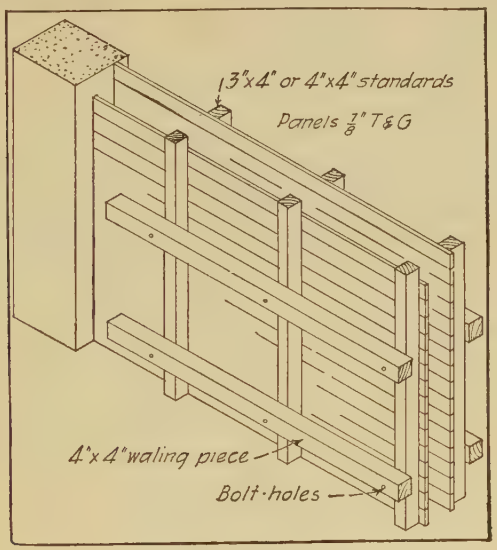


FIG. 2.—Wall construction with waling pieces.

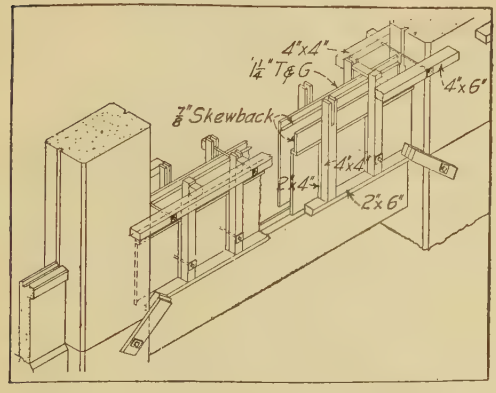


FIG. 3.—Typical form for spandrel curtain wall.

Shores and posts, usually 4 by 4 in., rough. Occasionally 6 by 6 in. for special cases of very heavy loads or stories too high for 4 by 4-in. posts.

Beam and girder bottom, 2 by — in., dressed 4 sides to $1\frac{3}{4}$ by (*required width*) in.

Beam and girder sides, $1\frac{1}{2}$ by — in., dressed 4 sides to $1\frac{1}{4}$ by (*required width*) in.

Cleats or battens 1 by 4 in., $1\frac{1}{4}$ by 4 in. or 2 by 4 in., rough.

Ledgers $1\frac{1}{4}$ by 4 in. or 2 by 4 in., rough.

Spreaders 3 by 4 in., rough.

Floor panels 1 by 6-in. roofers, T & G.

Before making up the lumber list figure out the weight to be carried by the forms, and the resultant allowable spacing of the shores. The weight of the concrete is usually taken at 150 lb. per cubic foot. The following tables, taken from the "Cambria Handbook," give the safe loads in pounds uniformly distributed, including the weight of the beam itself, for rectangular beams 1 in. thick. The safe load for a beam of any thickness may be found by multiplying the values given in the tables by the thickness of the beam in inches. It is well to bear in mind, however, that these tables are computed for sound structural timber, while much of the lumber entering into form work falls short of this quality. For additional safety, therefore, the values given should be somewhat reduced.

Span, feet	Spruce									Short leaf yellow pine								
	Depth of beam in inches																	
	4	5	6	7	8	9	10	11	12	4	5	6	7	8	9	10	11	12
1																		
2																		
3																		
4	311	486	700							444								
5	249	389	560	762	996					356	556							
6	207	324	467	635	830	1,050	1,296			296	463	667	907					
7	178	278	400	544	711	900	1,111	1,344	1,600	254	397	571	778	1,016				
8	156	243	350	476	622	788	972	1,176	1,400	222	347	500	681	889	1,125			
9	138	216	311	423	553	700	864	1,046	1,244	198	309	444	605	790	1,000	1,235		
10	124	194	280	381	498	630	778	941	1,120	178	278	400	544	711	900	1,111	1,344	1,600
11	113	177	255	346	453	573	707	856	1,018	162	253	364	495	646	818	1,010	1,222	1,455
12	103	162	233	318	415	525	648	784	933	148	231	333	454	593	750	926	1,120	1,333
13	96	150	215	293	383	485	598	724	862	137	214	308	419	547	692	855	1,034	1,231
14	89	139	200	272	356	450	556	672	800	127	198	286	389	508	643	794	960	1,143
15	83	130	187	254	332	420	519	627	747	119	185	267	363	474	600	741	896	1,067
16	78	122	175	238	311	394	486	588	700	111	174	250	340	444	563	694	840	1,000
17	73	114	165	224	293	371	458	554	659	105	163	235	320	418	529	654	791	941
18	69	108	156	212	277	350	432	523	622	99	154	222	307	395	500	617	747	889
19	65	102	147	201	262	332	409	495	589	94	146	211	287	374	474	585	708	842
20		97	140	191	249	315	389	471	560	89	139	200	272	356	450	556	672	800

The formula of the American Railway Engineering and Maintenance of Way Association for unseasoned short-leaf pine and spruce posts is as follows:

$$L = 1{,}100 \times \left(1 - \frac{1}{60d}\right)$$

in which:

L = Safe load in pounds per square inch
l = Length of post, in inches
d = Least diameter of post, in inches
1,100 = Bending extreme fiber safe working stress.

The formula is intended for railroad bridges, trestles, etc. For convenience a table of values computed for 4 by 4-in. and 6 by 6-in. posts is given herewith, based on this formula:

SPRUCE OR SHORT-LEAF YELLOW PINE

Length in feet	Least diameter of post in inches	
	4	6
6	12,300 lb.	31,600 lb.
8	10,500 lb.	29,000 lb.
10	8,800 lb.	26,400 lb.
12	7,000 lb.	23,800 lb.
14	5,200 lb.	21,100 lb.
16	3,500 lb.	18,500 lb.
18	1,700 lb.	15,800 lb.
20	No value	13,200 lb.

In high stories it may be advisable to use 6 by 6-in. shores, or else spike two 4 by 4's together. Single 4 by 4's over 12 ft. long, and 6 by 6's over 16 ft. long, should be cross-braced or stay-lathed in both directions at intervals of 6 or 7 ft. Where shores are stay-lathed do not use more than three-fourths of safe carrying capacity of the longest section between the stay-lathing, when consulting the tables. It must also be borne in mind that if stay-lathing is required for shores under forms, it is also required for the reshores.

An important item in making up the lumber list for a job is the reposting or reshoring to support the green concrete until it has aged sufficiently to be self-supporting.

Because of the speed with which concrete buildings are ordinarily erected, the dead load of the next story is frequently placed on concrete

scarcely a week old, when we know that it has only a part of its ultimate strength. This means that to carry the successive stories as they are erected, there should always be at least two stories fully reposted (in addition to the shores under the forms) and one additional story partly reposted. This story should have at least half the reshores in place. This is shown in Fig. 4 which is a vertical section through a typical bay of a building. These rules apply to summer or warm weather work carried on at the rate of about a story per week. For winter work or greater speed at least one additional story fully reshored is required, and sometimes more, depending upon the individual job conditions.

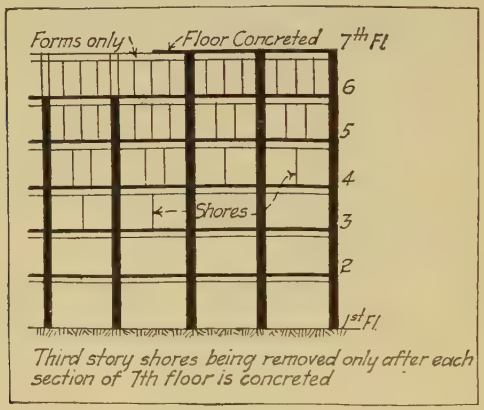


FIG. 4.—Typical arrangement of re-shores—concrete is between three and four weeks old before all the re-shores are removed.

A safe stripping schedule is as follows, based on summer conditions:

1. Columns, 24 hr. after floor slab is placed.
2. Girders, 60 hr. after concreting (third day).
3. Beams, 84 hr. after concreting (fourth day).
4. Panels any time after the beams.

Flat slab forms should not be removed earlier than indicated in the schedule below, which is based on the practice of a firm that has successfully handled much of this work.

Columns—24 hr. after slab is concreted.

Depressed heads (drop panels)—36 hr. after concreting.

Slab—84 hr. after concreting.

This schedule, like that given above for beams and girders, is intended for summer or warm weather conditions. For cold weather the time should be increased.

Column construction is simplest and the board marks least conspicuous when the boards run vertically. For small columns, ⅞-in. roofers may be used, but the common practice is to use 1¼-in. lumber, dressed four sides, tongued and grooved (D 4 S, T & G).

Column sides are stiffened and braced by yokes or battens, according to the system of clamping preferred by the contractor. With yokes, bolts or rods with malleable iron clamps are most frequently used. With battens different types of patented form clamps are adopted. Concrete exerts a pressure on the forms equal to that of a liquid weighing

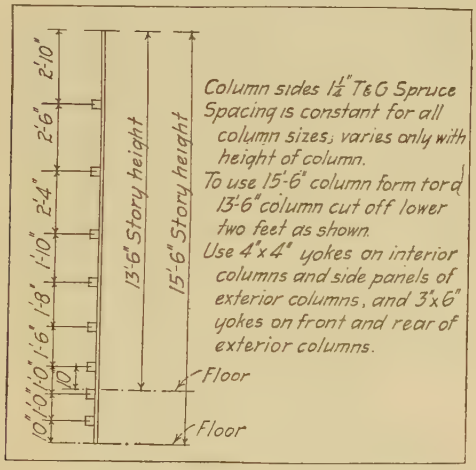


Fig. 5.—Schedule for vertical section of column yokes or clamps.

approximately 125 lb. per cubic foot. As this is twice the weight of water, the necessity for ample strength in yokes and bracing will be readily seen. The pressure varies with the depth, not with the thickness of the concrete in the column. The yokes are spaced more closely toward the bottom of the column; this is where the pressure is greatest.

A schedule of yoke spacing is given in Fig. 5 for 13-ft. 6-in. and 15-ft. 6-in. story heights. Three by six inch face yokes may usually be used for columns up to about 3-ft. or 3-ft. 4-in. face, but for columns having a face width greater than 3 ft. generally the better policy is to use 4 by 6-in. yokes. For columns having a face width close to 5 ft. it is best to through bolt the lower half of the column in the center, to relieve the strain on the yokes for the long span.

The arrangement of column sides shown in Fig. 6 is very largely used and has been found simple to build and reduce. The drawing shows a

rectangular form for convenience in referring to the different panels. The face panels (as marked on the drawing) are usually called the "sides" and the narrower panels, which fix the thickness of the column, are called the "ends."

A square column would be built just the same as the drawing shows, the dimensions of the different panels alone being changed.

After the panels are assembled the bolts are placed and tightened up, and the wedges shown in the drawings driven down between the bolts and the 4 by 4-in. cleat or yoke piece on the ends, to hold the end panels tightly in place against the sides.

Bolts for column forms are usually $\frac{5}{8}$ in. Half-inch bolts have been used with satisfaction, but for some types of form construction are too light to withstand the strain of wedging against them.

Three-fourth-inch bolts are heavier than necessary in building construction, and have generally been abandoned except for special heavy work.

Figure 7 shows an exterior column completely assembled in place. After the form is assembled complete it is of course supported by the floor, but provision must be made to support the outside face of the column temporarily, as this is always the first piece to be hoisted and set in place. Reference to the drawing will show how this is done. Near the top of the column form two bolts will be seen on the interior face. In a corresponding position in the story below will be seen two 4 by 4-in. brackets. Before the column is concreted 9-in. stud-bolts with nuts on the inside end are placed in the two bolt holes and allowed to project about 4 in. outside the form. When the column is stripped these bolts remain in place in the concrete, and the 4 by 4 blocks are slipped over them and tightened up. Before being placed these blocks have had a notch cut in one end, as shown, so that when the form is hoisted it is stepped into these two notches, and held uprightly by 2 by 4-in. braces run back to blocking on the floor. The remaining panels are set up in position when convenient.

Because of the interference of the beams on the building line, the top yoke on the column is not continuous around it, and special provision has to be made to keep the upper part of the column form from bulging out. This is done by means of a pair of 3 by 6-in. vertical cantilever stiffeners, or standards, bolted to the highest continuous yoke, and long enough to bear against the next yoke below and the top yoke above. By using this arrangement it is not necessary to bolt through the exterior beams. It is usual to tie the columns together as shown in Fig. 7 by means of 2 by 4's run parallel to the building line to the adjacent exterior columns, and 2 by 6's run to the opposite interior column.

There are a number of places where the octagonal column form can be used to good advantage. Details are given in Fig. 8. The general

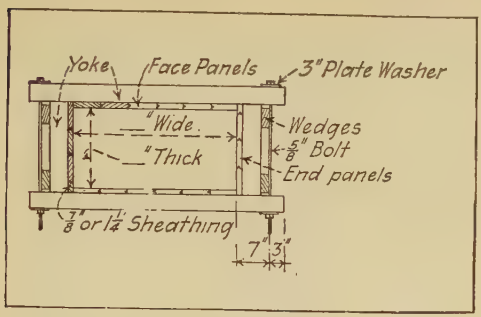


FIG. 6.—Plan of form for typical square or rectangular column.

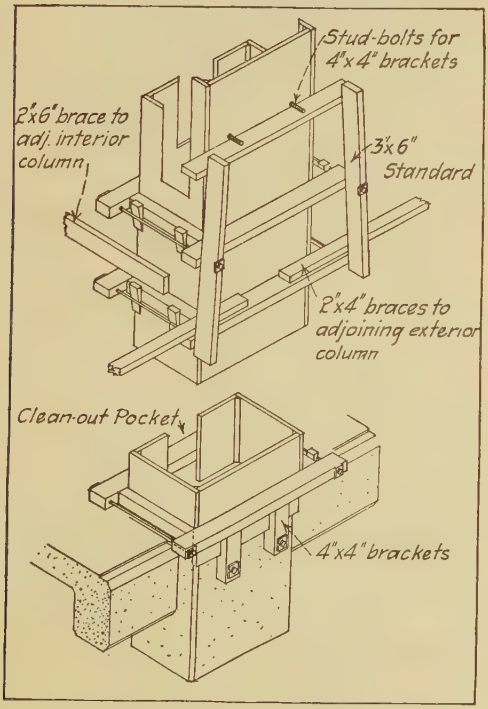


FIG. 7.—Exterior column form set in place.

method of construction is similar to that followed for square columns, except the panels on the yokes are no wider than may be necessary to engage the bevel pieces in the corners. This makes it necessary

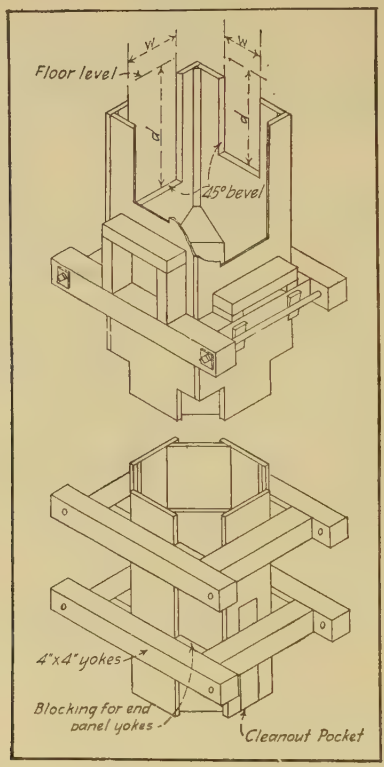


FIG. 8.—Typical octagonal column form.

Notation. W = Beam or girder width plus 1 in. for margin around opening.
d = Beam or girder depth, plus thickness of slab, plus $\frac{7}{8}$ in. for thickness floor panel, plus $\frac{1}{2}$ in. margin at bottom of opening.

to put a small bearing block on the long yokes for the "end" panel to bear against.

CIRCULAR COLUMNS

Sheet metal forms for circular columns are not designed to carry the weight of the floor form construction. So provision must be made to

support either the drop panel, in flat slab construction, or the beams and the girders framing into the column in beam and girder forms. A support has been detailed in Figs. 9 and 10. This bent can be used equally well for either beam and girder or flat slab construction by varying the height dimension as required. Uprights are 4 by 4's, the top horizontal brace is a 2 by 10, the lower horizontal brace and the diagonals 1 by 6's. The bent is made up of two sides, each of which is permanently assembled; the two sides are set up in place either side of the column center, and the movable horizontal braces dropped into place in sockets on the sides of

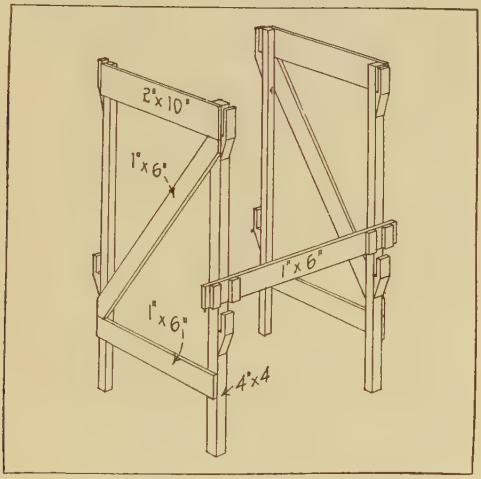


FIG. 9.—Bent for supporting floor forms at column when sheet metal column forms are used.

the bents. If necessary the completed frame is stiffened with temporary diagonal staylathing of 1 by 6's. In stripping, the horizontal braces are lifted out of the sockets, and after the wedges have been removed from under the posts the two bents may be taken down and hoisted to the next floor complete, ready for reassembling.

A minor problem occasionally encountered is that of holding in place a column which adjoins an existing building. An arrangement similar to that shown in Fig. 11 has proved very satisfactory. The frame of 4 by 4's and 4 by 6's is made up separately and put into place as a unit and the wedges between the column yokes and the vertical 4 by 6 are driven afterward to make the whole frame tight.

The perspective sketch Figs. 12 and 13 gives a good idea of the general arrangement of beam and girder forms. The girder forms span between columns, and are generally supported by blocking up form the top column yoke. If metal column forms are used, the girders are supported by a scaffold or bent similar to that previously shown. The beam forms are carried by the girder forms, generally by spiking a piece of 2 by 4 to the outside of the girder form just below the beam opening. The floor panels are made up with 3 by 4-in. spreaders on the back in place of battens. These spreaders rest on a 1¼ by 4-in. ledger nailed to the cleats on the

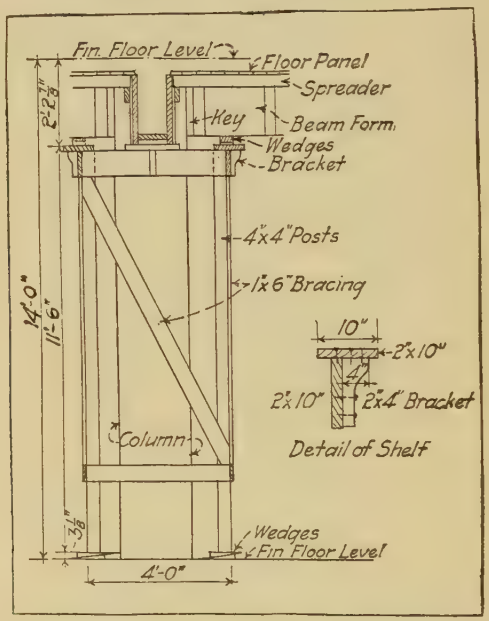


FIG. 10.—Column bent with beam and girder forms in place.

outside of the beam form. A 3 by 4-in. spreader will not carry as great a load as a 2 by 6, but the number of spreaders is usually fixed by the allowable span for the ⅞-in. boards of which the panel is made, and this is 2 ft. 6 in. or less. Under these conditions, for the usual 4 or 4½-in. slab found in building construction, spanning about 6 ft. between beams, a 3 by 4 spreader is strong enough, and it has the additional advantage that it does not overturn in handling or under load as readily as a 2 by 6.

When the concrete is poured the pressure will force all the abutting form surfaces tightly together. If the sides are made full length, the

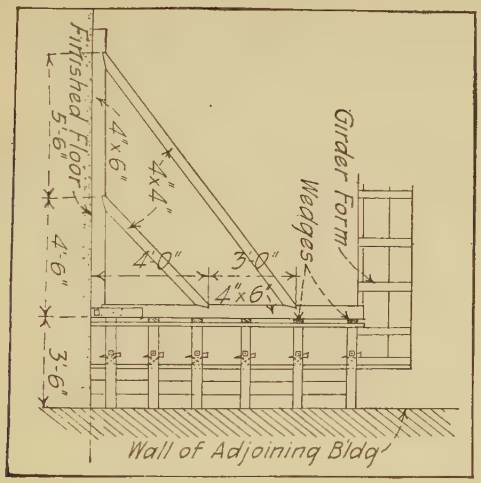


Fig. 11.—Method of bracing column forms against an existing wall.

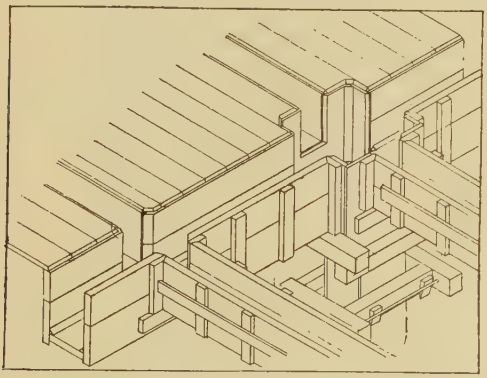


Fig. 12.—Perspective of beam and girder assembly at column.

pressure of the column forms against the ends of the girder form will make it next to impossible to get the form down. If the sides are made an inch or more short at each end a removable "key" piece may be inserted as

shown in Fig. 14, which shows the condition at the junction of column and girder forms, or beam and girder forms, the details being similar in each case. The key, being bevelled, can usually be removed without difficulty, but if it sticks, it can be chopped out without injury to the main form, thus providing the clearance required. The bottom form may be made

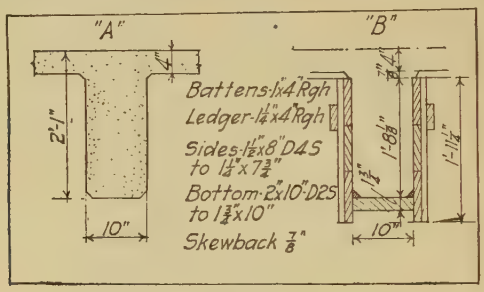


Fig. 13.—Details of typical beam or girder form. (Girder form does not require the ledger.)

practically full length, as clearance is provided as soon as one end is pried down.

Exterior beams present an additional problem in bracing, as there is no panel and spreader construction on the building line side to keep the form from opening up wider at the top than it is at the bottom. Two methods are generally used to keep the outside of the beam in line. The first is

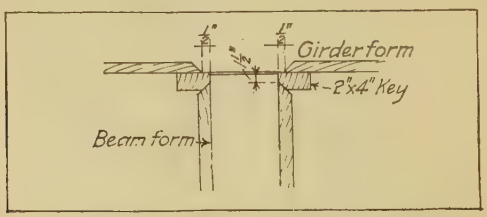


Fig. 14.—Detail at junction of beam and girder; or beam or girder and column.

to put a large number of shores under the beam and put spur braces at an angle of 45 deg. between the "T" head on the shore and the side of the beam. This method has several disadvantages. It requires an unnecessarily large number of shores, and also requires that the head of the shore be two or three times as long as would otherwise be necessary. There is the labor of cutting and nailing in place a large number of the small spur

braces, and the final disadvantage that the form will often spring anyway, and there is then no practicable method of getting it back into line. This has caused some contractors to adopt the method shown in Fig. 15. A 2 by 8-in. or 2 by 10-in. plank, depending on the span between columns, is spiked flat to the top yoke of the columns, and wedges are

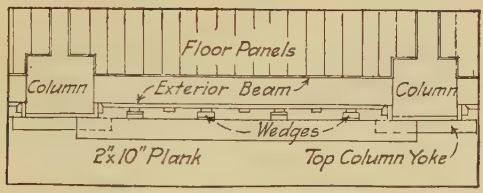


FIG. 15.—Method of bracing exterior beams to avoid bulging.

then driven between the plank and the beamside as often as may be necessary to hold the beamside in line. Then, if the form does show signs of working out of line because of spring in the plank, it is a simple matter to drive down such wedges as may be necessary to correct the trouble, while the pouring is going on. By this method no more shores are required than for an interior girder, and the "T" head need be only long enough to give the girder a bearing. This makes the shores much easier

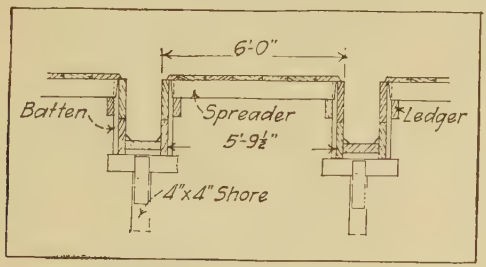


FIG. 16.—Section through floor forms to show relation between beam forms and floor panels.

to handle. As cutting is rarely required scaffold plank can be used for this bracing to good advantage without extra expense for special material.

Figure 16 gives a cross-section through two beams, which shows the construction. The spreaders are 3 by 4 in., rough, sized at the ends to 3¾ or 3½ in.

One of the oldest, simplest and most used methods of flat slab form construction is shown in Figs. 17, 18, 19. The upper part of the drawing

shows the disposition of the panels and the lower part of the drawing the arrangement of 4 by 6's and spreaders.

For the sake of simplicity in this and other drawings, shores have been omitted. Their spacing under the 4 by 6's is governed largely by the weight of the floor slab, which limits the span of the 4 by 6's. It is

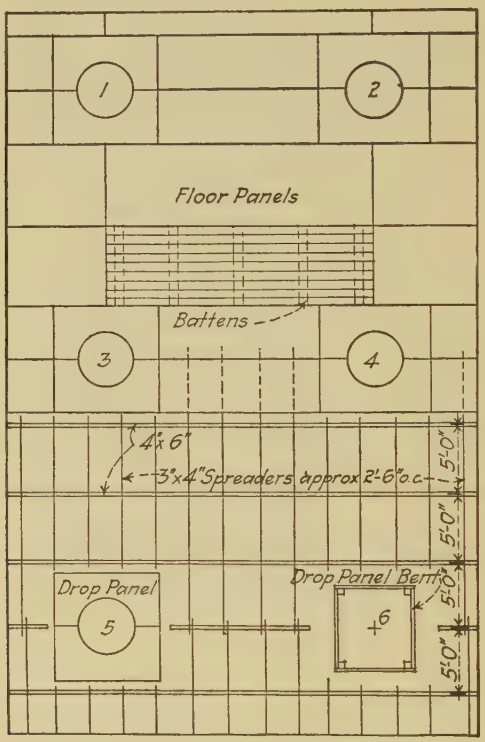


FIG. 17.—Loose-spreader system of flat slab forms.

worth noting that 4 by 6's are now generally used for ledgers instead of the former 2 by 8 or 2 by 10 plank. It was expensive work cutting a seat in the end of the plank to hold the plank securely, but if this was not done it was found that cleats alone could not be relied upon. The plank when put in place were green, and if a delay occurred in pouring the first floor they would warp and cup in seasoning. On winter weather jobs the heat

of the salamanders would sometimes cause them to curl violently and force off the cleats which held them in bearing on top of the shores, with a consequent failure of part of the floor form system. As a 4 by 6 will usually carry a sufficient load and be more stable, plank ledgers have been generally abandoned.

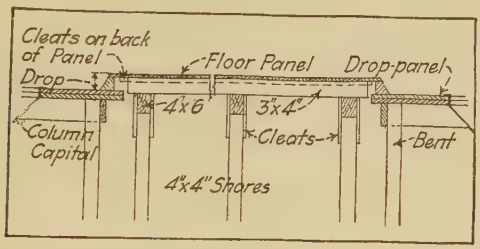


FIG. 18.—Section through form system shown in Fig. 17, taken parallel to the spreaders.

A system of forms for jobs with square bays and in which the drop panels can be made of the right size, is shown in Fig. 20. These panels are all exactly the same in size and shape and are therefore completely interchangeable. The drop head shown is two-fifths of the length of the bay. As will be seen, three rows of 4 by 6 bents are set up between the

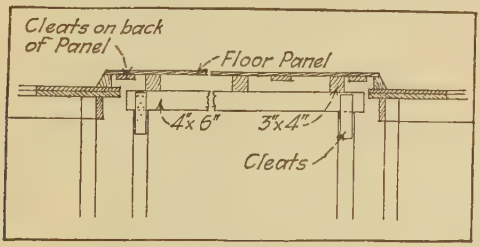


FIG. 19.—Section through form system shown in Fig. 17, taken across the spreaders.

lines of columns, the same as in Fig. 17, but between the columns three short bents are used running in the opposite direction. Because of the close spacing of the 3 by 4's or 2 by 4's, which act as battens on the back of the panels, they are usually quite stiff and stand handling well, in addition to being somewhat lighter than the panels used in the first system described.

An excellent method of building forms is shown in Fig. 21, 22 and 23. Instead of making the panels with longitudinal spreaders on which the boards are placed crosswise, as shown in Fig. 20, these panels are made up very much like those for beam and girder construction, the boards

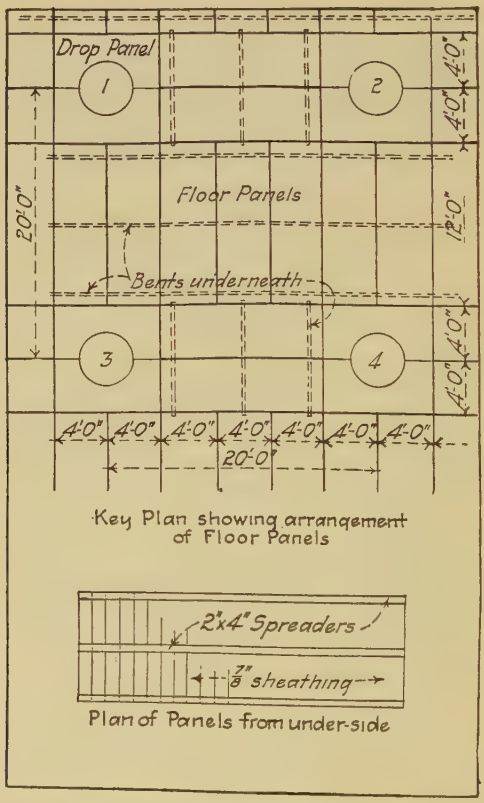


FIG. 20.—Flat slab form system for buildings with square bays.

running the length of the panel, with transverse spreaders on the back spaced according to the load to be carried and the span between the rows of 4 by 6 bents. As the longitudinal joints between the panels come over the center line of the 4 by 6's, accurate spacing of the bents is essential, and is obtained as follows, shown also by sketch. A 2 by 6

spacer plank is bolted from one column bent to the next one, at right angles to the line of 4 by 6's. These 2 by 6's are all drilled to a standard spacing, so that they automatically furnish a check on the location of the column bents. Each 2 by 6 carries a set of 1 by 4 guide cleats, which project about 4 in. above the top of the plank, and so located that

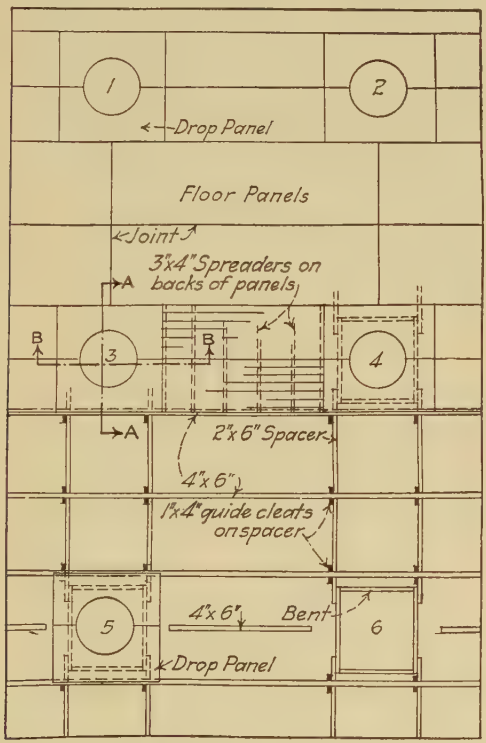


FIG. 21.—A system of flat slab forms that has been found very practical.

it is only necessary to drop the 4 by 6's into the space between the guide cleats to ensure their being exactly in position to catch the edges of the panels. One 4 by 6 bent is needed between the columns parallel to the rest of the 4 by 6's, to catch the two short panels. This bent can be readily placed after the other bents are up by the use of stay-lathing on which the position of the bents has been marked. As the 2 by 6 spacer

plank does not actually carry any of the construction load, it does not have to be bolted up with nut and washer.

The operation of setting up these forms then becomes quite simple. After the first column bent has been properly located with regard to its column center in both directions, it is only necessary to locate the succeeding bent in the same row approximately. The 2 by 6 is lifted into position at the first bent and pinned with a bolt. The second bent is moved

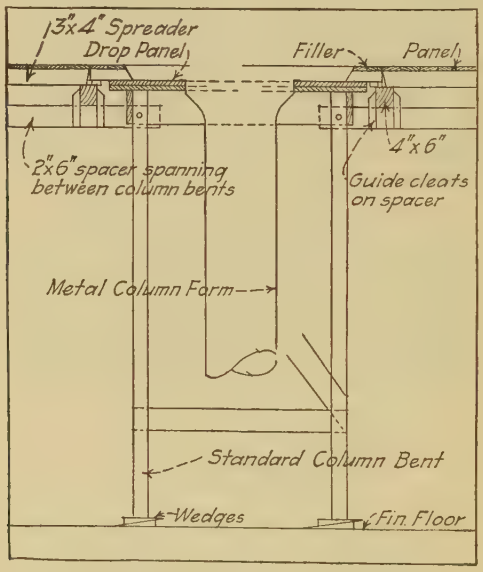


FIG. 22.—Section at "*A-A*" in Fig. 21.

backward or forward until the other end of the 2 by 6 can be pinned the same way and the process again repeated. The 4 by 6's are then dropped into place between the guide cleats and the shores placed under them, after which the panels may be laid down with the assurance that everything will fit as it should. Because of the fact that everything is so nearly automatic, some carpenter foremen claim to be able to get better form costs with this system than with any other type of flat slab forms.

Figure 24 shows two different methods of building these panels. The type at the left of the illustration is the more generally used in one form or another, although some carpenter foremen who have used both types claim that the other type is much better. It is a small matter, depending

principally upon the individual foreman's way of working. The first type shown is made up of a single thickness of ⅞ roofers stiffened and held

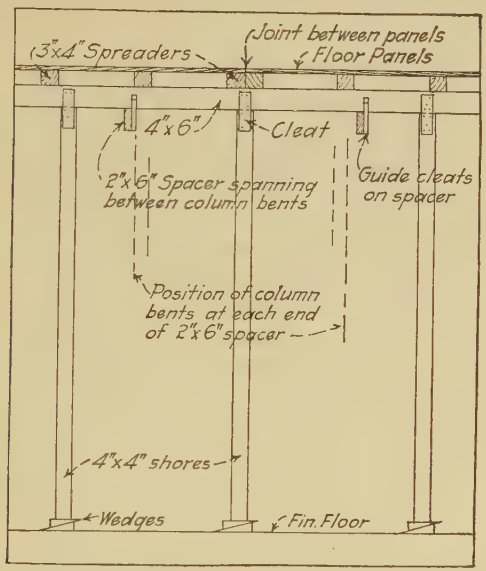


FIG. 23.—Section of the forms shown in Fig. 21 taken parallel to "*B-B*," but between columns.

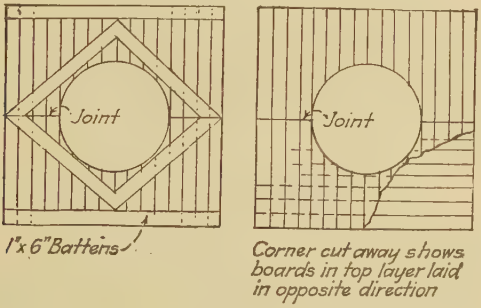


FIG. 24.—Two methods of making up the drop panel at the column capital.

in place by battens or cleats on the back of the panel. The battens as shown in the drawing are 1 by 6's, but the common practice is to use 2 by

4's on edge to make the panel rigid. The other panel is made up of two layers or laminations of roofers laid in opposite directions. This panel has all the advantages of any laminated construction as far as strength is concerned, and will stand more grief than the first type of panel.

Costs of Actual Jobs.—The following notes on estimating and the accompanying cost data are furnished through the courtesy of Guy Deming, C. E., of Far Hills, New Jersey, and are taken from his notebook covering a number of typical reinforced concrete industrial buildings of various sizes built in upper New York State and Pennsylvania. Inasmuch as these are figures actually obtained in the field they will serve to show the contractor whether the allowance he is making is too high or too low.

It is impossible to give full details regarding each of the buildings from which data has been taken, as there are over fifty. The essential pertinent features are given beside the job numbers in each case. That there is a wide variation in these figures cannot be denied, but it is because these wide variations have actually been obtained in the various jobs. This only emphasizes the need for accurate estimating. The reasons for these variations are found principally in the character of the territory. In numerous small or medium-sized towns local labor was more or less completely unfamiliar with the construction. In some cases it was possible to send in the nucleus of a gang upon which to work up a local organization. In other cases it was necessary to start at the bottom and build the job crew from the ground up. The question of relative efficiency in different districts also enters into the problem. On the whole, however, a careful study of the figures for the various items of different jobs will soon show which are high and which are low consistently, and allowance can be made accordingly.

LABOR RECEIVING MATERIAL

The following table gives the labor required to unload and pile cement, aggregate and lumber per unit of material. The total quantity handled is given in thousands of feet board measure of form lumber, barrels of cement and cubic yards of aggregate. The column headed (H) indicates the number of times the material had to be handled. "Cars" means that material was delivered to a siding at the job in cars and unloaded direct to piles by hand (with exception

of case noted). "Truck" means that material was delivered to the job by a truck belonging to the dealer. The labor is for unloading and piling only:

	Lumber, M. ft.				Cement, bbl.				Aggregate, cu. yd.			
Job No.	Total	H	Cars	Truck	Total	H	Cars	Truck	Total	H	Cars	Truck
3	.....	2	....	2.52	.....	2	....	0.38	.....	2	....	1.02
17	.....	...	....	2.47	.....	2	....	0.35	.....	2	....	0.18
27	.....	...	2.84	....	.....	...	0.18	....	.....	...	1.12	
31F	87.1	...	2.12	....	3,246	...	....	0.29	2,477	1	....	0.41
39	67.2	...	2.31	....	2,286	...	0.37	....	1,483	...	2.80	
42	.....	...	2.04	....	.....	...	0.22	....	.....	...	0.91	
48	80.9	...	2.31	....	1,702	...	0.22	....	1,321	...	1.03	
57S	275.2	1	2.49	....	11,046	1	0.22	....	7,943	...	1.12	
58S	202.0	...	3.00	....	10,882	1	0.28	....	9,164	1	....	0.19
59S	165.6	1	....	2.84	5,150	1	0.20	....	4,108	1	.64[1]	
62S	91.2	1	....	4.50	2,763	1	0.24	....	1,604	...	....	0.18
79	121.6	...	....	....	2,202	1	0.30	....	2,180	...	....	0.28
80S	103.3	1	3.60	....	2,390	1	0.39	....	1,760	1	....	0.38
86F	58.2	1	2.92	....	1,296	1	0.21	....	735	1	0.31	
43W	.....	...	....	....	527	...	0.20	....	487	...	0.95	
Average...	.....	...	2.62	3.08	.....	...	0.25	0.31	.....	...	1.11	0.38

F = Fall S = Summer W = Winter

[1] Unloaded from cars with conveyor.

LABOR FOR MAKING FORMS

The following table includes all labor and carpenter hours from the time the material is taken from the stock piles until it is set in place for the first time as forms in the building. It also includes the labor of carrying away from the building and the disposing of forms after they have been lowered from the roof.

Jobs are classified by self-supporting floor area to the nearest even 5,000 sq. ft., and costs are subdivided for carpenter (C) and labor (L). First the job identification number is given and then the area of each floor and the total self-supporting area in the building.

In some cases where the author's notes showed the total amount of lumber actually made up into forms, this is also given. This is of course greatly in excess of the total area of the self-supported floor.

FLAT SLAB JOBS

Job No.	Self supported floor, per sq. ft.	Area, total sq. ft.	Classified by area per self-supporting floor in sq. ft.					
			5,001–10,000		10,001–15,000		Over 15,000	
			C	L	C	L	C	L
69	10,575	31,725	....	....	13.4	14.2		
3[1]	11,220	35,055	....	....	10.4	13.4		
27[1]	12,280	73,820	....	....	6.9	2.4		
31[2]	5,220	26,030	10.1	7.9				
42[3]	9,717	32,472	....	....	15.2	15.2		
57[1]	24,300	72,900	....	....	....	....	11.6	9.9
58[3]	20,300	124,890	....	....	....	....	10.0	9.2
80[2]	7,500	15,000	10.2	11.4				
8	.....	34,877	....	....	16.0	12.0		
Average for all			C = 11.5			L = 10.6		

[1] Working and storage space poor.
[2] Working and storage space fair.
[3] Working and storage space good.

BEAM AND GIRDER JOBS

Job No.	Self-supported area		Total feet lumber used	Classified by area per self-supporting floor in sq. ft.					
				Less than 5,000		5,001–10,000		Over 15,000	
	Per floor, sq. ft.	Total, sq. ft.		C	L	C	L	C	L
17	4,491	27,009	.....	15.4	16.2				
39	3,660	18,290	.....	23.0	9.7				
48[1]	7,075	14,150	80,900	....	....	16.1	9.1		
51[2]									
59[1]	15,200	73,600	165,600	....	....	....	....	13.9	15.7
62[1]	6,000	31,110	91,200	....	....	19.2	12.6		
79[2]	7,000	(1)	121,600	....	....	17.1	9.8		
43[1]	.....	.....	29,000	....	....	18.1	12.2		
11[1]	.....	(2)	109,400	....	....	....	....	12.0	3.9
14[1]									
36[1]	(3)	12,775	22,000	13.0	4.8				

Average for all C = 16.4 L = 10.2
Average 11 and 36 Omitted C = 17.4 L = 12.2

(1) Hopper bottoms and roofs.
(2) Foundations and large bins.
(3) "Tin pan" floor.

[1] Working and storage space good.
[2] Working and storage space fair.

LABOR FOR PLACING FORMS

The table that follows gives the hours of carpenter (C) and common labor (L) per square foot of the floor area for stripping forms, hoisting them to the story above and placing them ready to receive the concrete. The figures given are the average in each case for the entire job.

BEAM AND GIRDER FLOORS

Job No.	Character of layout	Self-supported area		Area per self-supported floor					
		Per floor, sq. ft.	Total, sq. ft.	Less than 5,000		5,001–10,000		10,001–15,000	
				C	L	C	L	C	L
17W	Straight	4,491	27,009	0.068	0.114				
39	Straight	3,660	18,290	0.181	0.161				
48	Cut up	5,950 8,200	14,150	.....	.....	0.134	0.076		
51	Cut up	.....	.....	.....	.....	0.172	0.198		
59S	Straight	15,200	73,600	.....	.....	0.111	0.102		
62S	Straight	6,000	31,110	.....	.....	0.110	0.127		
79S	Very special	7,000	14,000						
86S	Straight	3,080	12,080	0.112	0.151				
Average		.....	.....	0.120	0.142	0.132	0.126		

Average for all C = 0.124 L = 0.132

S = Summer W = Winter

FLAT SLAB FLOORS

Job No.	Character of layout	Self-supported area		Area per self-supported floor					
		Per floor, sq. ft.	Total, sq. ft.	5,001–10,000		10,001–15,000		15,001–up	
				C	L	C	L	C	L
69	.....	10,575	31,725	.....	.....	0.074	0.106		
3	.....	11,220	35,055	.....	.....	0.046	0.069		
27	.....	12,280	73,820	.....	.....	0.069	0.066		
31F	Straight	5,220	26,030	0.051	0.065				
42	.....	9,717	32,472	0.065	0.071				
57	.....	24,300	72,900	.....	.....	.....	.....	0.061	0.073
58S	Straight	20,300	124,890	.....	.....	.....	.....	0.044	0.039
80S[1]	Straight	7,500	15,000	0.117	0.087				
Average	.....	.....	.....	0.078	0.074	0.063	0.080	0.052	0.056

Average for all C = 0.066 L = 0.073

S = Summer F = Fall

[1] 16-ft. 9-in. story height.

COLUMNS

Column form costs are estimated on the basis of linear footage. The figures are classified according to whether the column is square, rectangular, octagonal, or round. The erection or placing of pedestal forms also has to be considered when footings are below the normal floor line. Pedestal costs have been divided according to whether or not it is necessary to yoke them up, in the same manner as for columns. If yoking is required, the cost is naturally higher. The costs are for a laborer and a carpenter to place and strip complete. The column costs are for a carpenter and laborer to strip, hoist and place ready for concrete, the same as with floor forms. The labor to make and set up the forms for the first time, and the removal after lowering to the ground when the roof is on, are taken care of under the "Making" classification.

Labor for Column Forms

Job No.	Story height	Pedestals				Columns					
		Yoked		Not yoked		Square or rectangular		Octagonal		Round	
		C	L	C	L	C	L	C	L	C	L
69	.....	....	....	.....	.....	1.33	0.75				
3	13′–5″	0.58	0.30	.....	.....	1.25	0.98				
17	13′–3″	....	....	.....	.....	....	....	1.16	0.73		
27	13′–4″	....	....	.....	.....	2.00	0.56				
31	12′–0″	1.06	0.44	.....	.....	0.80	0.58				
39	11′–7″	2.17	0.40	.....	.....	1.69	1.13				
42	12′–0″	....	....	.....	.....	0.99	0.73				
48	15′–0″	0.48	....	.....	.....	1.06	0.24				
51											
57S	.....	....	....	.....	.....	1.96	1.03				
58S	14′–7″	....	....	0.044	0.057	0.80	0.55				
59S	.....	....	....	.....	.....	1.03	0.55				
62S	.....	0.81	0.66	.....	.....	1.23	0.93				
79S	.....	0.37	0.10								
80S	16′–9″	0.49	....	.....	.....	1.49	0.83	....	....	1.29	0.36
86											
76	.....	....	....	0.075	0.023						
78S	.....	0.99	0.09								
84	.....	....	....	0.297	.....	....	....	0.69	0.85		
74	.....	....	....	.....	.....	....	....	0.45	0.44		
64	.....	0.58	0.26								
66	.....	....	....	.....	.....	....	....	....	....	0.57	0.20
56	.....	....	....	0.20	0.010						
87W	.....	....	....	.....	.....	....	....	0.39	0.12		
43	.....	0.42	0.38	.....	.....	0.80	0.30				

Average for all C = 0.124 L = 0.132

S = Summer W = Winter

WALLS

(Costs of labor to make wall forms per square foot of contact area)

Job No.	Total wall area, sq. ft.	Labor		Notes
		Carpenter	Common	
69	.....	0.244	0.138	Foundation and part first story
3	4,603	0.167	0.059	Mostly spandrel
17	9,899	0.188	0.130	Mostly spandrel
27	6,067	0.281	0.085	
31	1,669	0.270	0.096	
39	6,330	0.353	0.092	
42	11,021	0.288	0.122	
48	3,317	0.249	0.117	
51	8,037			
57	20,228	0.286	0.097	
58	2,557	0.306	0.054	
59	5,670	0.238	0.060	Foundation
62	16,330	0.227	0.132	Mostly spandrel
79	19,879	0.247	0.321	
80	2,950	0.214	0.067	Foundation
86	1,835	0.199	0.063	
43	4,603	0.186	0.072	Foundation
	Average..	0.246	0.106	

Installing Plant.—The labor hours given in this table were taken from records made for a group of jobs, and give the amount of carpenter and common labor required for general installation work including setting up the mixer, building hoist towers and making run panels. It also includes erecting job shanties, bins for materials and similar plant items which are not a part of the actual building construction.

LABOR FOR SETTING UP PLANT

Job No.	Area per floor	Total area	Cu. yd. in job	Labor per cu. yd.		Lumber, board feet per cu. yd.
				Carpenter	Common	
69	10,575	31,725	2,167	0.65	0.86	8.6
03	11,220	33,035	1,873	0.52	0.75	21.8
17	4,491	27,009	1,458	0.45	0.82	19.6
27	12,280	73,820	3,742	0.58	0.57	7.6
31W	5,220	26,030	1,450	0.71	0.72	8.6
39W	3,700	18,284	1,055	0.59	1.49	14.4
42W	9,717	32,472	1,705	0.54	1.03	11.1
80[1]	7,500	15,000	1,402	0.69	0.55	29.1
12	16,100	96,600	4,027	0.30	0.68	5.0
Average.....	.....	.....	.....	0.56	0.83	
Average omitting 3 winter jobs.....				0.52	0.70	

W = Winter jobs. S = Summer jobs.

[1] Includes material for construction of special shed for handling and storing bulk cement.

CONCRETING

This table gives the labor for mixing, hoisting, and placing concrete, including the time of the hoisting engineer and the foreman on the floor, as well as that of the gangs charging the mixer. The cost of receiving the cement and the aggregate are not included as these are covered under a separate item.

This concrete was all placed with 6-ft. capacity carryalls. The jobs are classified by yardage and according to whether they are beam and girder, or flat slab. The concrete mixer was usually placed in a pit with a fixed charging hopper of ¾- or 1-cu. yd. capacity at grade. The mixer in general was driven from the pinion shaft of the hoist, which in turn was belt driven from the electric motor. The time for cleaning out column and beam forms preparatory to placing concrete is included. The labor for greasing forms is included in labor charged to form construction.

HOURS OF LABOR PER CUBIC YARD FOR MIXING AND PLACING CONCRETE

Job No.	Self-supported area		Area per self-supported floor							
			Less than 5,000		5,001–10,000		10,001–15,000		Over 15,000	
	Per floor	Total	B. & G.	F.S.	B. & G.	F.S.	B. & G.	F.S.	B. & G.	F.S.
69	10,575	31,725	....	....	....	....	....	3.51		
3	11,220	35,055	....	....	....	....	....	4.00		
17	4,491	27,009	4.15							
27	12,280	73,820	....	....	....	....	....	3.28		
31	5,220	26,030	....	....	....	3.28				
42	9,717	32,472	....	....	....	4.64				
48	5,950 8,200	14,150	....	....	4.95					
39	3,660	18,290	5.89							
57	24,300	72,900	....	....	....	....	....	....	....	3.80
58	20,300	124,890	....	....	....	....	....	....	....	3.68
59	15,200	73,600	....	....	....	....	....	....	1.85	
62	6,000	31,100	....	....	3.78					
80	11,250	22,500	....	....	....	....	....	4.59		
43	.....	.....	....	....	3.84					

Average all, 3.94.
Average without No. 59, 4.10.

REINFORCEMENT

The charges against the reinforcement have been divided in such a manner as to afford a comparative check on the costs of the various items of the work. Column 1 gives the total tonnage of steel on the job, Column 2 the tonnage to be bent, and Column 3 the percentage of Column 2 to the whole. This does not include spirals which are correspondingly handled in Columns 4 and 5. Column 6 gives the labor of receiving steel which also includes the time for unloading from the cars and racking it in storage. The handling in Column 7 takes care of all labor except the receiving, placing or bending operations, which are covered under Columns 6, 8, and 9 respectively. Column 9 includes the time for making up column hoops and stirrups as well as for bending beam and girder reinforcement. Spirals are given in Column 10 which includes the time necessary to make up the spirals on the job, when the spirals are not bought pre-fabricated.

Labor per ton for Placing Reinforcement

	1	2	3	4	5	6	7	8		9		10	
Job No.	Total tonnage on job	Tonnage bent	Per cent of total tonnage bent	Tonnage of spirals	Per cent of total tonnage spirals	Receiving labor	Handling labor	Placing		Bending and fab.		Fab. spirals	
								Labor	Mech.	Labor	Mech.	Labor	Mech.
12	222.4	33.9	15.2	11.1	5.0	1.94	8.8	8.8	....	11.8	....	22.8	
13	85.4	26.0	30.5	....	...	2.88	10.4	23.4	....	21.6			
17	88.4	39.8	45.0	2.6	2.9	1.59	7.8	5.1	....	9.6	....	22.6	
27	265.2	40.4	15.2	23.6	8.9	1.35	13.2	....	10.9	....	19.3	....	22.4
42	98.7	24.0	24.4	2.8	2.8	0.83	0.92	6.5	....	9.2	....	6.2	
54	1922.0	265.0	13.8	140.0	7.3	4.58	17.3	....	8.7	....	22.7	....	25.0
58	398.0	81.0	20.4	21.0	5.3	2.14	8.7	5.9	....	20.0	....	10.0	
59	262.8	114.8	43.6	5.4	2.0	1.18	8.5	8.0	....	20.4	....	7.8	
62	92.4	42.9	46.5	1.1	1.2	3.20	9.3	....	5.8	....	12.0	....	8.1
72	446.0	208.0	46.6	15.0	3.4	3.00	12.3	....	9.4	....	18.0	....	25.4
80.	87.2	13.0	15.0	....	...	3.78	8.2	6.5	....	24.8			
86	42.8	20.0	46.7	....	...	2.18	15.5	....	8.3	....	15.9		
43	9.2	3.7	40.3	....	...	1.43	4.8	13.0	....	25.6			

Plant Installation.—This is an item on which more contractors go wrong than on probably any one other item in the average concrete building. Many jobs are "overplanted," with the result that the carrying charges or plant rental for mechanical equipment designed

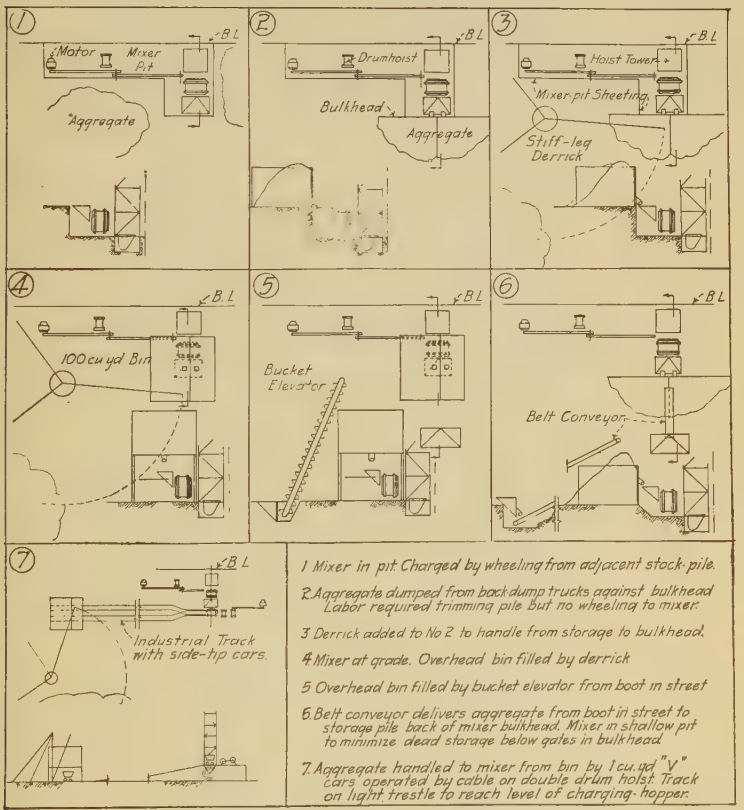


FIG. 25.

to save labor will amount to more than the cost of the labor saved by its use.

The subject is covered very completely in Vol. XIX (1923) of the Proceedings of the American Concrete Institute, which may be summarized as follows:

The Committee on Contractor's Plant agreed that most construction plant layouts could be classified as modifications of seven types. For each of these seven layouts estimates of plant cost on a depreciation basis were prepared for ¾-yd. and 1-yd. mixing, hoisting and placing plants. This was done both for placing by wheeling and by chutes. It was assumed that ¾-yd. plants might be used for jobs up to 4,000 cu. yd. involving the use of the following plant: ¾-yd. mixer, 1-yd. hoist bucket, single drum hoist, 50-hp. electric motor, 50-ft. high wood tower, 8 concrete carts and 300 lin. ft. of run panels.

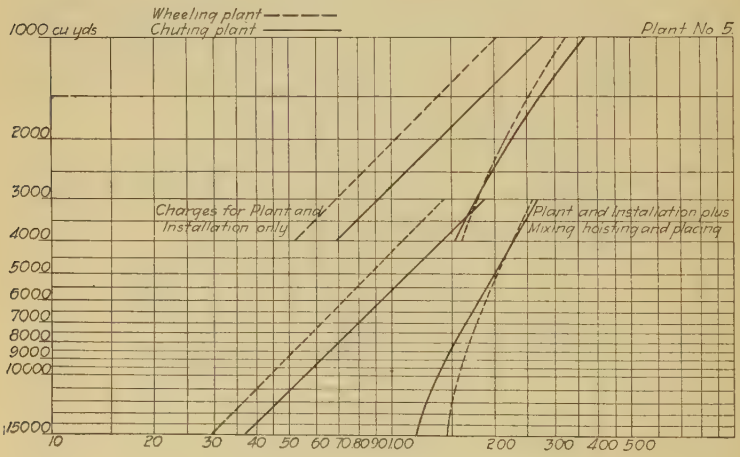
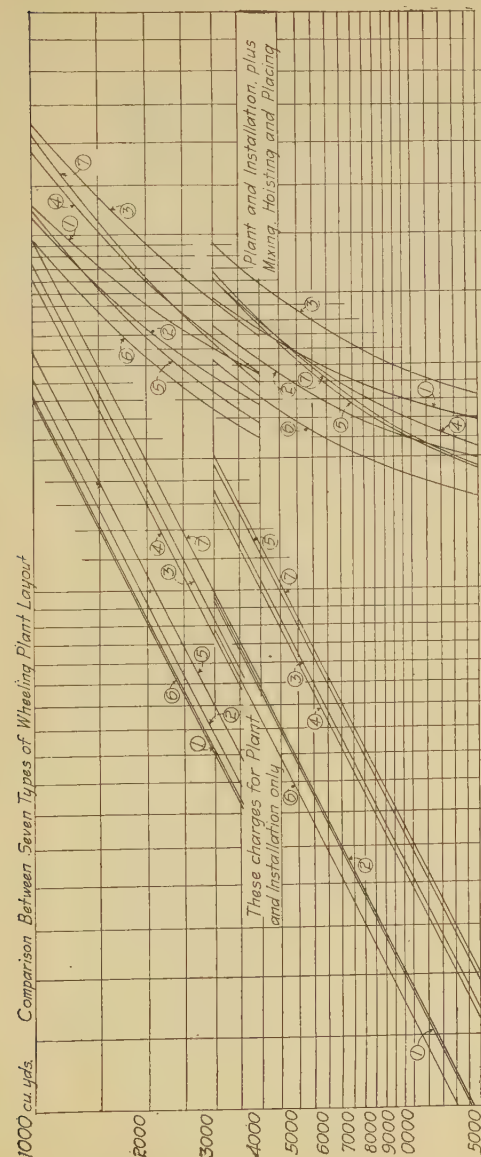


Fig. 26.

One cubic yard plants involved a 1-yd. mixer and hoist bucket, 75-hp. motor and single drum hoist, 125-ft. wood hoist tower and 400 ft. of run panels.

Chuting equipment (alternate) was of the so-called 100-ft. radius type with a steel tower 120 ft. high for ¾-yd. jobs and 180 ft. high for 1-yd. jobs, with a double drum hoist for speed in raising and lowering the sliding frame.

Depreciation allowances were based on jobs running from eight months to one year, for jobs of over 8,000 cu. yd. For jobs of from 4,000 to 8,000 cu. yd. the allowances would be high, but on the side of safety. For ¾-yd. jobs the depreciation was taken at 60 per cent of


1000 cu. yds. Comparison Between Seven Types of Wheeling Plant Layout
Plant and Installation, plus Mixing, Hoisting and Placing
These charges for Plant and Installation only
2000
3000
4000
5000
6000
7000
8000
9000
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4-
4.50
5-

FIG. 27.

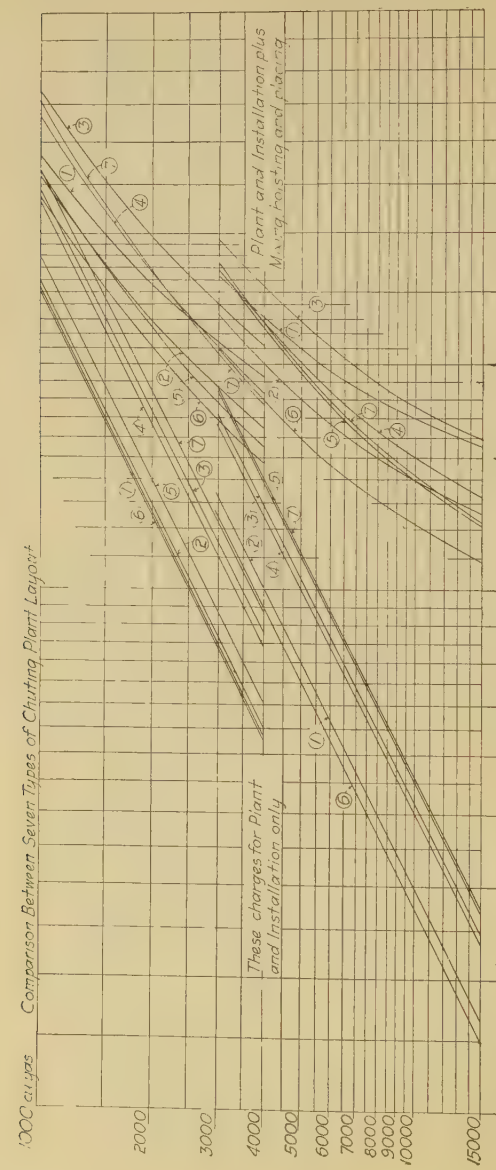

Comparison Between Seven Types of Chuting Plant Layout
These charges for Plant and Installation only
Plant and Installation plus Mixing, hoisting and placing
1000 cu yds
2000
3000
4000
5000
6000
7000
8000
9000
10000
15000
20
30
40
50
60
70
80
90
100
1.50
2-
2.50
3-
3.50
4-
4.50
5-

FIG. 28.

the annual figure. Wooden framed structures such as towers, bins, etc., were assumed to be used but once, and the jobs charged with full value of the lumber entering into them. This was done on account of the varying practice among contractors with regard to this item. In general it has been found that the salvage on lumber will just about offset the labor of dismantling. The labor of placing the concrete was estimated for ¾- and 1-yd. jobs for each layout for both wheeling and chuting conditions, and the results, platted in the form of two sets of curves, one for wheeling and one for chuting. Each set in turn is subdivided into jobs up to 4,000 yd. (¾ yd.) and above 4,000 yd. (1 yd.). For each in turn, each plant layout is platted twice: once for plant and installation alone (straight line curve) and again with the charge for labor and power added. These last two items remain practically constant per yard regardless of whether the job is large or small, being affected chiefly by the layout of the plant which determines the number of men required for concreting.

These curves are reproduced herewith. They cannot be followed blindly, but should serve as a guide as to probable plant charges. They are interesting as showing in numerous cases the varying economies of different arrangements of the plant at different yardages.

FIREPROOFING FOR SKELETON STEEL BUILDINGS, CINDER CONCRETE FLOOR AND ROOF CONSTRUCTION

How to Estimate.—In making an estimate for cinder concrete floor and roof construction supported between steel beams, the first thing an estimator should do is to read the specification concerning his part of the work, noting special clauses in the "General Conditions" which affect all contractors. He should next examine thoroughly the steel and architectural plans, especially such cross-sections and details as show the floor and roof construction and the beam and girder protection and their relation to the surrounding work. Very often there are special details of construction shown in connection with the floor and roof work which must be taken into consideration when compiling an estimate for fireproofing, as they vitally affect the cost of the work.

It is always advisable to use the steel framing plans in conjunction with the architectural floor plans, taking measurements from the steel framing plans. One should never depend on scaling the plans in lieu

of using dimensions. Prints have a faculty of shrinking, causing the measurements to be considerably less than the actual sizes. The

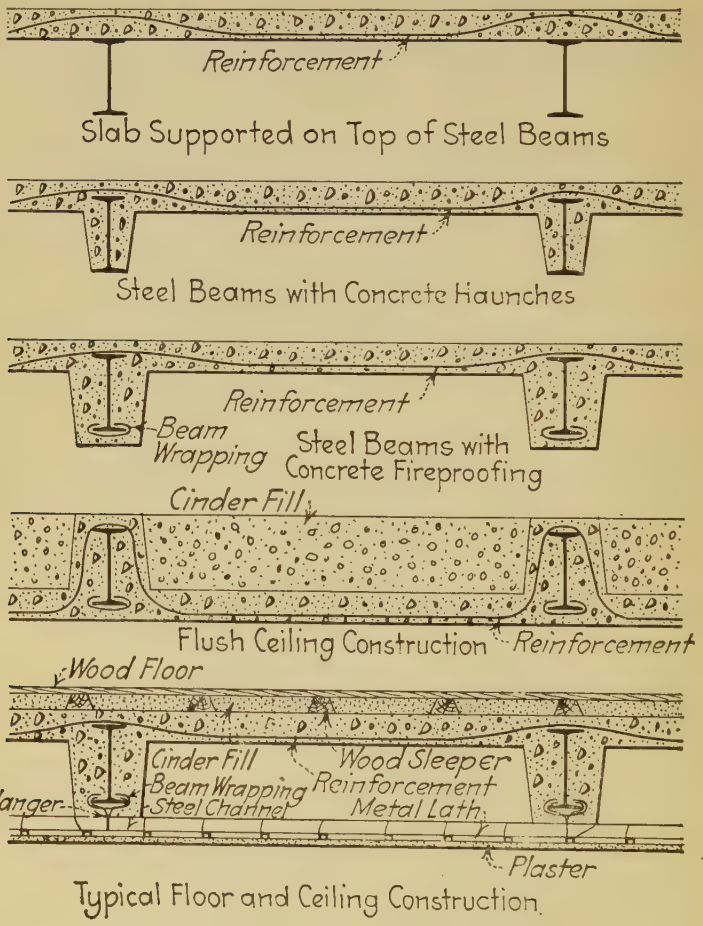


FIG. 29.—Types of concrete floors.

live and dead loads on the various floors should be noted as the floor area is taken off in square feet, and particularly the thickness of the floor slab and its relation to the tops of the floor beams and girders.

TABLE SHOWING SQUARE FEET OF CENTERING AND CUBIC FEET OF CONCRETE PER LINEAR FOOT OF BEAM
CARNEGIE BEAMS—2-IN. PROTECTION

Size and weight of I		Full size	½ in. off	1 in. off	1½ in. off	2 in. off	2½ in. off	3 in. off	3½ in. off	4 in. off	4½ in. off	5 in. off	5½ in. off	6 in. off	6½ in. off	7 in. off	7½ in. off	8 in. off
4-in. 7.7 lb.-I....	Sq. ft.	1.56	1.47	1.39	1.31	1.22	1.14	1.06	0.97	0.89	0.81	0.72	0.64					
	Cu. ft.	0.277	0.254	0.231	0.208	0.185	0.162	0.139	0.115	0.093	0.069	0.046	0.023					
5-in. 10.0 lb.-I....	Sq. ft.	1.75	1.67	1.58	1.50	1.42	1.33	1.25	1.17	1.08	1.00	0.92	0.83	0.75	0.67			
	Cu. ft.	0.340	0.316	0.292	0.267	0.243	0.219	0.194	0.170	0.146	0.122	0.097	0.073	0.049	0.024			
6-in. 12.5 lb.-I....	Sq. ft.	1.94	1.86	1.78	1.69	1.61	1.55	1.44	1.36	1.28	1.19	1.11	1.03	0.94	0.86	0.78	0.69	
	Cu. ft.	0.407	0.382	0.356	0.331	0.305	0.280	0.254	0.229	0.204	0.177	0.153	0.127	0.102	0.076	0.051	0.025	
7-in. 15.3 lb.-I....	Sq. ft.	2.14	2.06	1.97	1.89	1.81	1.72	1.64	1.56	1.47	1.39	1.31	1.22	1.14	1.06	0.97	0.89	0.81
	Cu. ft.	0.479	0.452	0.426	0.399	0.372	0.346	0.319	0.293	0.266	0.239	0.213	0.186	0.160	0.133	0.106	0.08	0.053
8-in. 18.4 lb.-I....	Sq. ft.	2.33	2.25	2.17	2.08	2.00	1.92	1.83	1.75	1.67	1.58	1.50	1.42	1.33	1.25	1.17	1.08	1.00
	Cu. ft.	0.556	0.528	0.500	0.472	0.444	0.417	0.389	0.361	0.333	0.306	0.278	0.250	0.222	0.194	0.167	0.139	0.111
9-in. 21.8 lb.-I....	Sq. ft.	2.53	2.44	2.36	2.28	2.19	2.11	2.03	1.94	1.86	1.78	1.69	1.61	1.53	1.44	1.36	1.28	1.19
	Cu. ft.	0.636	0.607	0.578	0.550	0.521	0.492	0.463	0.434	0.405	0.376	0.347	0.318	0.289	0.260	0.231	0.203	0.174
10-in. 25.4 lb.-I....	Sq. ft.	2.72	2.64	2.56	2.47	0.239	2.31	2.22	2.14	2.06	1.97	1.89	1.81	1.72	1.64	1.56	1.47	1.39
	Cu. ft.	0.722	0.692	0.662	0.631	0.601	0.571	0.541	0.511	0.481	0.451	0.421	0.391	0.361	0.330	0.301	0.271	0.241
12-in. 31.8 lb.-I....	Sq. ft.	3.08	3.00	2.92	2.83	2.75	2.67	2.58	2.50	2.42	2.33	2.25	2.17	2.08	2.00	1.92	1.83	1.75
	Cu. ft.	0.875	0.844	0.813	0.781	0.750	0.719	0.688	0.656	0.625	0.594	0.563	0.531	0.500	0.469	0.438	0.406	0.375
15-in. 42.9 lb.-I....	Sq. ft.	3.63	3.54	3.46	3.38	3.29	3.21	3.13	3.04	2.96	2.88	2.79	2.71	2.63	2.54	2.46	2.38	2.29
	Cu. ft.	1.12	1.09	1.06	1.02	0.990	0.957	0.924	0.890	0.858	0.825	0.792	0.759	0.726	0.693	0.660	0.627	0.594
18-in. 54.7 lb.-I....	Sq. ft.	4.17	4.08	4.00	3.92	3.83	3.75	3.67	3.58	3.50	3.42	3.33	3.25	3.17	3.08	3.00	2.92	2.83
	Cu. ft.	1.39	1.35	1.32	1.29	1.25	1.22	1.18	1.14	1.11	1.08	1.05	1.01	0.972	0.938	0.903	0.868	0.833
20-in. 65.4 lb.-I....	Sq. ft.	4.52	4.44	4.35	4.27	4.19	4.10	4.02	3.94	3.85	3.77	3.69	3.60	3.52	3.44	3.35	3.27	0.319
	Cu. ft.	1.57	1.53	1.50	1.46	1.43	1.39	1.35	1.32	1.28	1.25	1.21	1.17	1.14	1.10	1.07	1.03	0.997
24-in. 79.9 lb.-I....	Sq. ft.	5.25	5.17	5.08	5.00	4.92	4.83	4.75	4.67	4.58	4.50	4.42	4.33	4.25	4.17	4.08	4.00	3.92
	Cu. ft.	1.99	1.95	1.91	1.87	1.83	1.80	1.76	1.72	1.68	1.64	1.60	1.57	1.53	1.49	1.45	1.41	1.38

TABLE SHOWING SQUARE FEET OF CENTERING AND CUBIC FEET OF CONCRETE PER LINEAR FOOT OF BEAM
BETHLEHEM BEAMS—2-IN. PROTECTION

Size and weight of I		Full size	½ in. off	1 in. off	1½ in. off	2 in. off	2½ in. off	3 in. off	3½ in. off	4 in. off	4½ in. off	5 in. off	5½ in. off	6 in. off	6½ in. off	7 in. off	7½ in. off	8 in. off
8-in. 17.5 lb.-I...	Sq. ft.	2.43	2.35	2.27	2.19	2.10	2.02	1.94	1.85	1.77	1.69	1.6	1.52	1.44	1.35	1.27	1.19	1.1
	Cu. ft.	0.64	0.61	0.58	0.55	0.51	0.48	0.45	0.42	0.385	0.353	0.321	0.289	0.257	0.225	0.193	0.161	0.128
9-in. 20.5 lb.-I...	Sq. ft.	2.62	2.52	2.45	2.37	2.29	2.20	2.12	2.04	1.95	1.87	1.78	1.70	1.62	1.53	1.45	1.37	1.28
	Cu. ft.	0.721	0.688	0.656	0.623	0.590	0.557	0.524	0.492	0.459	0.426	0.393	0.361	0.328	0.295	0.262	0.229	0.197
10-in. 23.5 lb.-I...	Sq. ft.	2.82	2.74	2.65	2.57	2.49	2.40	2.32	2.24	2.15	2.07	1.99	1.90	1.82	1.74	1.65	1.57	1.49
	Cu. ft.	0.821	0 787	0.752	0.718	0.684	0.650	0.616	0.581	0.547	0.513	0.479	0.445	0.410	0.376	0.342	0.308	0.274
12-in. 28.5 lb.-I...	Sq. ft.	3.18	3.10	3.01	2.93	2.84	2.76	2.68	2.59	2.51	2.43	2.34	2.26	2.17	2.09	2.01	1.92	1.84
	Cu. ft.	0.984	0.949	0.914	0.878	0.843	0.808	0.772	0.738	0.703	0.668	0.633	0.597	0.562	0.527	0.492	0.457	0.422
15-in. 38.5 lb.-I...	Sq. ft.	3.72	3.64	3.56	3.47	3.39	3.31	3.22	3.14	3.06	2.97	2.89	2.81	2.72	2.64	2.56	2.40	2.39
	Cu. ft.	1.26	1.22	1.18	1.15	1.11	1.07	1.04	0.999	0.962	0.925	0.888	0.851	0.814	0.777	0.740	0.703	0.666
15-in. 54.5 lb.-I...	Sq. ft.	3.75	3.68	3.58	3.50	3.42	3.33	3.25	3.17	3.08	3.00	2.92	2.83	2.75	2.67	2.58	2.50	2.43
	Cu. ft.	1.30	1.26	1.22	1.18	1.15	1.11	1.07	1.03	0.993	0.955	0.917	0.878	0.840	0.802	0.764	0.726	0.688
18-in. 49.0 lb.-I...	Sq. ft.	4.29	4.21	4.12	4.04	3.96	3.87	3.79	3.71	3.62	3.54	3.46	3.37	3.29	3.21	3.12	3.04	2.96
	Cu. ft.	1.56	1.56	1.52	1.48	1.43	1.39	1.36	1.32	1.28	1.23	1.20	1.16	1.12	1.08	1.04	1.00	0.958
18-in. 54.5 lb.-I...	Sq. ft.	4.30	4.22	4.13	4.05	3.97	3.88	3.80	3.72	3.63	3.55	3.47	3.38	3.30	3.22	3.13	3.05	2.97
	Cu. ft.	1.61	1.57	1.53	1.50	1.45	1.41	1.37	1.33	1.29	1.25	1.21	1.17	1.13	1.09	1.05	1.01	0.966
20-in. 59.5 lb.-I...	Sq. ft.	4.67	4.58	4.50	4.42	4.33	4.25	4.17	4.08	4.00	3.92	3.83	3.75	3.67	3.58	3.50	3.42	3.33
	Cu. ft.	1.83	1.79	1.75	1.70	1.67	1.63	1.58	1.54	1.50	1.46	1.42	1.38	1.33	1.29	1.25	1.21	1.17
20-in. 73.0 lb.-I...	Sq. ft.	4.73	4.65	4.56	4.48	4.40	4.31	4.23	4.15	4.06	3.98	3.90	3.81	3.73	3.65	3.56	3.48	3.40
	Cu. ft.	1.95	1.90	1.86	1.82	1.77	1.73	1.68	1.64	1.59	1.55	1.51	1.46	1.42	1.37	1.33	1.28	1.24
24-in. 73.5 lb.-I...	Sq. ft.	5.42	5.33	5.25	5.17	5.08	5.00	4.92	4.83	4.75	4.67	4.56	4.50	4.42	4.33	4.25	4.17	4.08
	Cu. ft.	2.35	2.30	2.26	2.21	2.17	2.12	2.08	2.03	1.99	1.94	1.90	1.85	1.81	1.76	1.72	1.67	1.62
26-in. 91.0 lb.-I...	Sq. ft.	5.79	5.71	5.62	5.54	5.46	5.37	5.29	5.21	5.12	5.04	4.96	4.87	4.79	4.71	4.62	4.54	4.46
	Cu. ft.	2.63	2.58	2.53	2.48	2.43	2.39	2.34	2.30	2.25	2.20	2.16	2.10	2.06	2.02	1.97	1.92	1.88
30-in. 121.0 lb.-I...	Sq. ft.	6.54	6.46	6.37	6.29	6.20	6.12	6.04	5.96	5.87	5.79	5.71	5.62	5.54	5.46	5.37	5.29	5.21
	Cu. ft.	3.22	3.17	3.12	3.07	3.02	2.97	2.92	2.87	2.81	2.77	2.72	2.67	2.62	2.57	2.51	2.47	2.42

All floor openings with an area of 20 sq. ft. or more should be deducted. Often the relation of the floor slab to the floor beams changes on the various floors, and at times the level and thickness of the slab changes on the same floor. After grouping all the flat slab work together in square feet according to the various slab thicknesses, the estimator should then proceed to take off the quantities for the beams and girders. The linear feet of all beams, girders, and channels throughout the floors and roof which are to be encased in concrete must then be totaled, keeping the various kinds having the same depth, weight and relation to the top of floor slab in groups. Where beams frame into girders or channels, a certain portion of either end of the beams is included in the concrete protection of the girder or channel. Allowance should be made for this in taking off the linear feet of beams requiring concrete protection, if any degree of accuracy is desired.

By referring to the tables, the amount of concrete required to encase a beam or girder having a given relation to the floor slab can be easily computed. These tables allow for 2-in. beam soffit protection and show the square feet of centering and the cubic feet of concrete required per lineal foot for the various sizes of beams. The use of such tables will aid in quickly computing the total materials required.

If it is desired to find the amount of concrete and the area of the forms required for a 12-in. 31.8-lb. Carnegie I-beam in a case where the 4-in. concrete floor slab finishes 2½ in. above the top of beam, and the soffit of the arch is 1½ in. below the top of the I-beam or 1½-in. "off," by referring to the tables, one will find 0.781 cu. ft. of concrete and 2.83 sq. ft. of forms required per linear foot of beam.

The square feet of centering can readily be computed by estimating the total area of the floor and roof slabs. This area should be kept separate from the centering for the beam and girder protection, the latter being obtained in the manner described above. Having the floor area and the linear feet of beams and girders, the amount of reinforcing material and the number of soffit clips can easily be obtained. Soffit clips are usually spaced about 12 in. on centers.

After all the quantities are taken off, the estimator's summary of quantities should appear in a form similar to the following:

Slab area, concrete..... C. Y.
Slab area, centering..... S. F.
Slab reinforcing..... S. F.
Beams and girder, concrete..... C. Y.
Beams and girder centering..... S. F.
Columns, concrete..... C. Y.
Columns, centering..... S. F.

Material Required for Forms.—In the average building with from 75,000 or 100,000 sq. ft. of floor slab, and girders not over 20 in. in depth, and where the floor beams are 12-in. I's spaced about 6-ft. 6 in. on centers, the following quantities of material would be required:

2½ board feet of lumber per square foot area
1 wire hanger of No. 8 wire for every 9 sq. ft.
1 soffit clip for every 6 sq. ft.
30 lb. of nails for every 1,000 sq. ft.

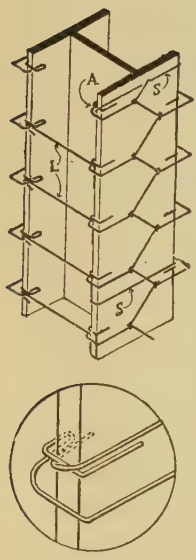


Fig. 30.—Showing S. M. C. on columns with detail of "A."

Labor to Install Forms.—In passing and handling the lumber for centering, in hanging the joists and in centering and stripping, the labor required to install 100 sq. ft. of floor area will be as follows:

Carpenters—installing centering..... 4 hours
Laborers—passing, handling and stripping centering..... 6 hours

Clips.—There are many forms of soffit clips on the market but the handiest are the various forms of wire clips. Of these, there are several of a caging type in which the mechanic draws the clip after him. There is also the loop type of wire clip, which the mechanic pushes ahead of him as he goes along.

A mechanic will install these clips on the beam soffits over an area of from 4,000 to 6,000 sq. ft. in a day of 8 hr., or on from 600 to 1,000 lin. ft. of beams.

The Cage types to which reference is made are known as the S. M. C., manufactured by

the Mitchel-Tappen Company of New York City, and the White Clip and the Reed Clip are manufactured by the Concrete Clip and Wire Company of New York City.

Price of Metal Caging.—The price of this caging varies somewhat due to the width of the flange of the various sized beams, but for the average width the present cost is 2½ cts. per foot for beams and 4½ cts. per foot for girders. These costs do not include haunch stiffeners, as these are only required in exceptional cases. The cost for channels, including the channel back, averages about 3¾ cts. per linear foot.

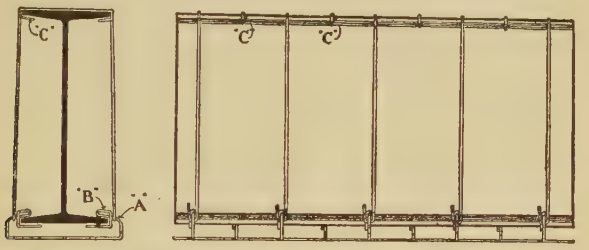


FIG. 31.—Showing S. M. C. on girders, including haunch stiffeners.

Reinforcing.—The reinforcement now generally used for flat arches is of cold drawn steel wire either of woven triangular mesh or of rectangular mesh in which the wires are electrically welded together. In the type of building under consideration mechanics will stretch the reinforcement and place the soffit clips on the beams over an area of 100 sq. ft. in 1.2 to 1.4 hr. The weight of wire mesh reinforcement, which is required for any given span and live load, can be readily obtained from the handbooks of the various manufacturers.

Labor for Placing Concrete.—If the concrete is mixed by hand, a gang of about 22 men will work to good advantage handling, mixing and wheeling the concrete, filling the beam haunches and soffits, and spreading the slabs. Exclusive of hoisting, 4 man hours must be allowed for each yard of concrete.

Labor on Columns.—For building centering for the concreting of columns which are finished square, it takes one carpenter and one laborer 6 hr. each to install 100 sq. ft. Laborers removing centering and handling lumber, 3 hr. per 100 sq. ft. Laborers mixing and placing 1 cu. yd. of concrete, 5 hr.

Mixing of Concrete.—There is very little difference in the cost of mixing cinder concrete by hand or by machine on the average job. If a mixer is on the job, it has been found in nearly all cases that the saving is about equal to the time of 3 men. The mixing of cinder concrete goes very fast owing to the lightness of the cinders. Except on very large jobs most contractors prefer not to bother with a mixer.

Hoisting.—Hoists should always be placed in a position in the building which is most advantageous to reach the entire floor area with a minimum amount of wheeling. The cost of hoisting per cubic yard depends largely on the amount of concrete placed in a day. In the vicinity of New York City, the present rental price of a machine is $15 per day. To this must be added the engineer's wages of $15 for an 8-hr. day, the cost of a guard rail, the electric current, the rigging, etc., which will ordinarily add $15 more per day, making a total cost of $45 per day. A good average day's work is about 60 cu. yd., thus making the cost of hoisting approximately 75 cts. per cubic yard. This is on the assumption that the building has from 75,000 to 100,000 sq. ft. of floor area.

General.—The most universal and economical type of concrete floor construction for the average type of skeleton steel building is that known as top construction, in which the concrete slab is at the upper flanges of the steel beams. The reinforcing of the slab is then continuous over the tops of the beams, or it may be necessary in some cases to have the reinforcing for a single span hooked over the top of the beams forming the span. This occurs where a much heavier floor load is required in certain spans and a heavier reinforcement is used. Instead of using heavier reinforcement and hooking it over the beams of the separate spans, the same object can be obtained by using the same reinforcement as used on the rest of the floor and then merely stretching additional reinforcement of a cross-section sufficient to take care of the additional load in that portion of the floor, allowing the reinforcement to extend about 1 ft. on either side beyond the special span. This will give a secure bond and take care of any additional load.

It has been found through experience and by various municipal and private tests that concrete of 1 part of Portland cement, 2 parts of sand and 5 parts of steam cinders makes a satisfactory fireproofing material, and owing to its lightness, the dead load of a building is considerably reduced, thereby lightening the structural steel require-

ments and keeping down the cost. Cinder concrete will weigh from 95 to 110 lb. per cubic foot depending largely upon its compactness. Care should be taken not to use an excess of water.

Owing to its economy in installation, wire mesh reinforcement is now generally used. This mesh reinforcement comes in various strengths to suit varying conditions of load and span.

The time given for the different parts of the work is the average for an ordinary office or loft building, of about 100,000 sq. ft., when favorably located. The estimator will realize that conditions may be such that the hours may change considerably, but the hours as given herein are from actual jobs recently performed.

Removal of Forms.—For 6-ft. spans, the forms should not be removed until concrete has had at least 4 days to set. For spans over 6 ft., one day must be allowed for each additional foot. The above is right for summer conditions, but in case of cold weather, additional time should be given depending upon the temperature.

STONE OR GRAVEL CONCRETE FIREPROOFING

Most of the information given for cinder concrete floor will apply also for stone and gravel concrete. There are, however, certain differences in cost that need to be taken into account. These are given below.

Formwork.—For cinder concrete floor slabs, the joists to support the forms can be spaced about 18 in. apart, while for the same slab for stone concrete, they should be spaced not more than 15 in. apart. This, of course, takes additional lumber, hangers, clips, etc. The cost for this additional work amounts to about ½ ct. per square foot of slab.

Mixing Stone Concrete.—The work of mixing stone concrete is considerably more than that for mixing cinder concrete. For jobs having 25,000 sq. ft. or more of slab area, it is always desirable to use a concrete mixer. In order to accomplish the same amount of work per day with stone concrete as would be accomplished for cinder concrete, it is necessary to increase the size of the gang from 22 to 30 men. The supervision of the labor would not be any more for 30 men than for 22 men, and hence the additional cost of labor should be about 25 per cent., or about 5 hr. per cubic yard.

Mixes of Concrete.—The usual mixes for gravel and stone concrete on floor slab work is 1 : 2 : 4. For quantities of material, see tables of mixes on page 118.

Sectional Area of Steel Fabric Reinforcement Required for Concrete Arches of Various Spans in Accordance with the New York City Building Code

4-in. cinder concrete slab 1 : 2 : 5 Mix

Total load per sq. ft. including weight of slab, lb.	Span								
	4 ft.	4 ft. 6 in.	5 ft.	5 ft. 6 in.	6 ft.	6 ft. 6 in.	7 ft.	7 ft. 6 in.	8 ft.
100	0.043[1]	0.043[1]	0.04	0.043[1]	0.046	0.054	0.063	0.072	0.082
125	0.043[1]	0.043[1]	0.043[1]	0.048	0.058	0.068	0.079	0.090	0.103
150	0.043[1]	0.043[1]	0.048	0.058	0.069	0.081	0.094	0.108	0.123
175	0.043[1]	0.045	0.056	0.068	0.081	0.095	0.110	0.126	0.144
200	0.043[1]	0.052	0.064	0.078	0.092	0.108	0.126	0.144	0.164
225	0.046	0.058	0.072	0.087	0.104	0.122	0.141	0.162	0.185
250	0.051	0.065	0.080	0.097	0.115	0.135	0.157	0.180	0.205
275	0.056	0.071	0.088	0.107	0.127	0.149	0.173	0.198	0.226
300	0.062	0.078	0.096	0.116	0.138	0.162	0.188	0.216	0.246
325	0.067	0.084	0.104	0.126	0.150	0.176	0.204	0.234	0.267
350	0.072	0.091	0.112	0.136	0.162	0.190	0.220	0.252	0.287
375	0.077	0.097	0.120	0.145	0.173	0.203	0.236	0.271	0.308
400	0.082	0.104	0.128	0.155	0.185	0.217	0.251	0.288	0.328
425	0.087	0.110	0.136	0.165	0.196	0.230	0.267	0.306	0.349
450	0.092	0.117	0.144	0.175	0.208	0.244	0.283	0.325	0.369

4-in. Stone or Gravel Concrete Slabs 1 : 2 : 4: Mix or Equal

100	0.043[1]	0.043[1]	0.043[1]	0.043[1]	0.043[1]	0.047	0.054	0.062	0.071
125	0.043[1]	0.043[1]	0.043[1]	0.043[1]	0.050	0.059	0.068	0.078	0.089
150	0.043[1]	0.043[1]	0.043[1]	0.050	0.060	0.070	0.082	0.094	0.107
175	0.043[1]	0.043[1]	0.049	0.059	0.070	0.082	0.095	0.109	0.124
200	0.043[1]	0.045	0.056	0.067	0.080	0.094	0.109	0.125	0.142
225	0.043[1]	0.051	0.062	0.076	0.090	0.106	0.122	0.141	0.160
250	0.044	0.056	0.069	0.084	0.100	0.117	0.136	0.156	0.178
275	0.049	0.062	0.076	0.092	0.110	0.129	0.150	0.172	0.196
300	0.053	0.067	0.083	0.101	0.120	0.141	0.163	0.187	0.213
325	0.058	0.073	0.090	0.109	0.130	0.153	0.177	0.203	0.231
350	0.062	0.079	0.097	0.118	0.140	0.164	0.191	0.219	0.249
375	0.067	0.084	0.104	0.126	0.150	0.176	0.204	0.234	0.267
400	0.071	0.090	0.111	0.134	0.160	0.188	0.218	0.250	0.284
425	0.076	0.096	0.118	0.148	0.170	0.199	0.231	0.266	0.302
450	0.080	0.101	0.125	0.151	0.180	0.211	0.245	0.281	0.320

[1] Minimum allowance of 0.12 per cent of sectional area of slab above center of reinforcement, used.

The following formula gives the required sectional area of reinforcement for concrete arches not exceeding 8-ft. spans.

$$A = \frac{WL^2}{dk}$$

Where

A = Sectional area of steel reinforcement in square inches per foot of width
W = Gross load in pounds per square foot
L = Span in feet
d = Distance from the top of slab to the center of reinforcement in inches
k = See table below.

Type of Reinforcement	Cinder Concrete	Stone Concrete
Non-continuous	$k = 14,000$	$k = 16,000$
Rods or other shapes securely hooked over or attached to the supports	$k = 18,000$	$k = 20,000$
Steel fabric continuous over supports	$k = 26,000$	$k = 30,000$

Note.—The minimum allowance is 0.12 per cent in the case of cold-drawn steel fabric and 0.25 per cent in the case of other forms, the percentage being based on the sectional area of slab above the center of reinforcement.

CONCRETE

Mixtures for Various Uses.—On important work where a large amount of concrete is to be used, it usually pays to make a careful sieve analysis of both the fine and the coarse aggregates. One can then proportion the mix in such a way as to secure the desired quality of concrete from the material available, with the greatest possible economy. There are, however, some things that must be left to the judgment of the engineer such as the maximum size of aggregate permissible and the required strength of concrete for various uses.

When the work is not of sufficient importance, or when circumstances prevent the making of a careful analysis of the aggregates, a table which gives what has been found to be required in good practice is very helpful. Such a table has been prepared by the Alpha Portland Cement Company, and through their courtesy is printed below.

Table of Recommended Mixtures and Maximum Aggregate Sizes for Various Uses

	Recommended Maximum Size of Aggregate in Inches
1:1:1 Mixture for	
The wearing course of two-course floors subject to heavy trucking, such as occurs in factories, warehouses, on loading platforms, etc	½
1:1:1½ Mixture for	
The wearing course of two-course pavements	¾
1:2:3 Mixture for	
Reinforced concrete roof slabs	1
One-course concrete road, street and alley pavements	3
One-course walks and barnyard pavements	1½
One-course concrete floors	1½
Fence posts	½
Sills and lintels without mortar surface	½
Watering troughs and tanks	1
Reinforced concrete columns	1
Mine timbers	¾
Construction subjected to water pressure, such as reservoirs, swimming pools, storage tanks, cisterns, elevator pits, vats, etc	1
1:2:4 Mixture for	
Reinforced concrete walls, floors, beams, columns, and other concrete members designed in combination with steel reinforcing	1
Concrete for the arch ring of arch bridges and culverts	1½
Foundations for engines causing heavy loading, impact and vibration	3
Concrete work in general subject to vibration	1½
Reinforced concrete sewer pipe	½
1:2½:4 Mixture for	
Silo walls, grain bins, coal bins, elevators and similar structures	1½
Building walls above foundation, when stucco finish will not be applied	1½
Walls of pits or basements, exposed to moisture	1½
Manure pits	1½
Dipping vats, hog wallows	1
Backing of concrete block	¾
Base of two-course road, street and alley pavements	3
1:2½:5 Mixture for	
Walls above ground which are to have stucco finish	1½
Base of two-course walks, feeding floors, pavements and floors	1½
Bridge abutments and wing walls, culverts, dams, small retaining walls	2
Basement walls and foundations where watertightness is not essential	2
Foundations for small engines	2
1:3:6 Mixture for	
Mass concrete—large retaining walls, heavy foundations and footings	3
1:1½ Mixture for	
Inside finish of water tanks, silos, and bin walls, where required, and for facing walls below ground when necessary to afford additional protection against the entrance of moisture	(To pass through No. 8 Screen)
Back plastering of gravity retaining walls	(To pass through No. 8 Screen)

1:2 Mixture for
- Facing block, ornamental, and other concrete products..... ¼
- Wearing course of two-course walks, floors subjected only to light loads, barnyard pavements, etc..... ¼

1:2½ Mixture for
- Scratch coat of exterior plaster (cement and stucco) (To pass through No. 8 Screen)
- Fence posts when coarse aggregate is not used..... ¼

1:3 Mixture for
- Intermediate and finish stucco coats..... (To pass through No. 8 Screen)
- Concrete block when coarse aggregate is not used..... ¼
- Concrete brick..... ¼
- Concrete drain tile and pipe when coarse aggregate is not used..... ¼
- Ornamental concrete products..... ¼

MATERIALS REQUIRED FOR 100 SQ. FT. OF SURFACE FOR VARYING THICKNESS OF CEMENT FINISH

Proportions.....	1:1		1:2		1:2½		1:3	
Thickness, in.	Cement, sacks	Sand, cu. yd.	Cement, (sacks)	Sand, cu. yd.	Cement, sacks	Sand, cu. yd.	Cement, sacks	Sand, cu. yd.
⅜	2.2	0.08	1.5	0.11	1.3	0.12	1.1	0.13
½	3.0	0.11	2.0	0.15	1.7	0.16	1.5	0.17
¾	4.5	0.16	2.9	0.22	2.5	0.23	2.2	0.25
1	6.0	0.22	3.9	0.29	3.3	0.31	3.0	0.33
1¼	7.5	0.27	4.9	0.36	4.2	0.39	3.7	0.41
1½	9.0	0.33	5.9	0.43	5.1	0.47	4.5	0.50
1¾	10.5	0.39	6.9	0.50	6.0	0.56	5.4	0.60
2	12.0	0.45	7.9	0.58	6.9	0.64	6.2	0.69

MATERIALS REQUIRED FOR 100 SQ. FT. OF SURFACE FOR VARYING THICKNESS OF CONCRETE SLAB

Thickness	1 in.			2 in.			4 in.			5 in.		
Mix	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone
1:2	3.9	0.29	....	7.9	0.58							
1:1:1	4.2	0.15	0.15	8.3	0.31	0.31						
1:1:1½	3.7	0.14	0.20	7.3	0.27	0.41						
1:1½:2½	2.6	0.14	0.24	5.1	0.28	0.47						
1:1½:3	....	....	....	....	....	....	9.4	0.52	1.04	11.7	0.65	1.30
1:2:3	....	....	....	....	....	....	8.6	0.64	0.95	10.8	0.80	1.19
1:2:4	....	....	....	....	....	....	7.4	0.55	1.10	9.3	0.69	1.37
1:2½:4	....	....	....	....	....	....	6.9	0.64	1.02	8.6	0.80	1.27
1:2½:5	....	....	....	....	....	....	6.2	0.57	1.14	7.7	0.72	1.43
1:3:6	....	....	....	....	....	....	5.2	0.58	1.16	6.5	0.73	1.45

Thickness	6 in.			7 in.			8 in.			9 in.		
Mix	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone
1:1½:3	14.0	0.78	1.56	16.4	0.91	1.82	18.7	1.04	2.08	21.1	1.17	2.34
1:2:3	12.9	0.95	1.43	15.0	1.11	1.67	17.2	1.27	1.90	19.3	1.43	2.14
1:2:4	11.1	0.82	1.64	12.9	0.96	1.92	14.8	1.10	2.19	16.7	1.23	2.47
1:2½:4	10.3	0.95	1.53	12.0	1.11	1.78	13.8	1.27	2.03	15.5	1.43	2.29
1:2½:5	9.2	0.86	1.72	10.8	1.00	2.00	12.3	1.14	2.29	13.9	1.29	2.57
1:3:6	7.9	0.87	1.74	9.2	1.02	2.03	10.5	1.16	2.32	11.8	1.31	2.61

NOTE.— Quantities expressed in the following units:
Cement...sacks; Sand...cubic yards; Pebbles or Broken Stone...cubic yards.

QUANTITIES OF MATERIAL REQUIRED FOR CONCRETE FOR A GIVEN STRENGTH[1]

Tests.—The studies made so far by the Lewis Institute Laboratory in this work include the making of about 100,000 tests and cover, among other things, the effect of the consistency of concrete, quantity of cement, grading of fine and coarse aggregate, curing conditions, age of concrete, etc. The tables show the fundamental relation between the quantity of mixing water and the quality of the resultant

[1] Data from *Bull.* No. 9 by DUFF A. ABRAMS and STANTON WALKER.

concrete. They also show that the size and grading of the aggregate and the quantity of the cement affect the strength of the concrete only in so far as they influence the water requirement. In other words the chief reason for making a rich mixture is in order to enable one to keep down the amount of water, expressed as a ratio to the volume of cement, and still have the concrete sufficiently workable to enable one to use it for the kind of work for which it is intended.

Purpose of Tables.—These tables are intended to be applied for the following purposes to all types of concrete work in which plastic mixtures may be used.

1. To furnish a guide in the selection of mixtures to be used in preliminary investigations of the strength of concrete.
2. To indicate proportions which may be expected to produce concrete of a given strength under average conditions where control tests are not made.
3. To furnish a basis for comparing the relative economies of concrete made by combining aggregates of different sizes, when the workability and strength of the resulting concrete are taken into account. (In other words, it is not necessary to restrict aggregate sizes to those usually mentioned in specifications.)
4. To furnish a basis for making changes in proportions to compensate for variations in the size and grading of aggregates, or in workability of the concrete during the progress of the work.
5. To figure the quantities for use in estimating costs, ordering material, etc., when the mix in known.

BASIS OF TABLES

The tables are based on the following considerations:

1. The compressive strength of concrete at 28 days tested in accordance with standardized methods, is taken as the basis of the quality of the concrete.
2. Tests were made by methods similar to those described in "Tentative Methods of Making Compression Tests of Concrete," of the American Society for Testing Materials. The essential features of the method are:

   (*a*) Aggregates of known sieve analysis.
   (*b*) Aggregates in room-dry condition.

(*c*) Unit volumes determined by standard methods.
(*d*) Cement assumed to weigh 94 lb. per cubic foot.
(*e*) Proportions by volume.
(*f*) Hand-mixed concrete puddled in 6- by 12-in. cylinder forms.
(*g*) Concrete cured in a moist place until tested.
(*h*) Tests made at the age of 28 days.
(*i*) Each value based on 5 or more specimens made on different days.

3. Studies of the average inter-relation of strength of concrete, size and grading of aggregate, quantity of cement and quantity of mixing water for the range covered by these tables.
4. Selection of sieve analyses of aggregate to represent average of materials of size-classification shown.
5. Determination of the most economical proportions of fine and coarse aggregates for each of the other conditions.
6. Yield of concrete determined by measurements and weights of 6- by 12- in. cylinders.

LIMITATIONS OF TABLES

The tables of proportions and quantities of materials furnish a guide in the selection of concrete mixtures and for comparing different mixtures within the following limitations:

1. Concrete must be plastic or workable.
2. Aggregates must be clean and structurally sound.
3. Aggregates must be graded between the sizes indicated.
4. Cement must meet the requirements of the Standard Specifications and Tests for Portland Cement of the American Society for Testing Materials.
5. Allowance must be made for temperatures below normal; low temperatures during the first few days of curing greatly reduce the strength of concrete.
6. The values in the tables of quantities represent the net volumes of materials in the finished concrete; no allowance is made for waste. For average conditions the following allowances for waste are suggested:
   Cement 2 per cent; fine aggregate 10 per cent; coarse aggregate 5 per cent.

These percentages do not include allowances for grouting, patching, washing or replacements. Allowance must be made when using the tables for the differences in volumes of aggregates measured dry by the laboratory method and when moist sand is measured in the loose condition common to field measurements. There will be but little difference in the measurements of broken stone or pebbles by the two methods, but the quantity of sand will be from 5 to 20 per cent less, according to the moisture content. These differences can be easily taken into account by the calibration of the measuring devices used.

7. These tables do not cover proportions for "semi-dry" concrete used in machine-made products.

INFORMATION NECESSARY FOR USE OF TABLES

The following information is necessary in order to make use of the tables:

1. Sieve analyses of aggregates made in accordance with the method described below.
2. Size-classification of aggregates.
3. Plastic condition of concrete required by the work, as determined by the slump test for workability.
4. Desired compressive strength of concrete at 28 days.

TEST METHODS

The information necessary for using the tables should be determined by the following methods:

Sieve Analysis of Aggregate.—The sieve analysis should be made in accordance with the "Tentative Method of Test for Sieve Analysis of Aggregate for Concrete," of the American Society for Testing Materials. The test is made by determining the cumulative percentages of material which is finer or coarser than each sieve.

Field tests can be made with sufficient accuracy by using alternate sieves in the standard set beginning with No. 50. The percentages for the omitted sieves can be determined by interpolation.

TEST METHODS

Size Classification.—The size to be assigned to a given aggregate is determined from the sieve analysis by applying the following rules:

1. At least 15 per cent shall be retained on the sieve next smaller than that considered the maximum size.

A graded sand with 16 per cent retained on the No. 8 sieve would fall in the No. 4 size; if 14 per cent or less were retained, the sand would fall in the No. 8 size. A coarse aggregate having 16 per cent coarser than the 2-in. sieve would be considered as 3-in. aggregate.

2. Not more than 15 per cent of a given coarse aggregate shall be finer than the sieve considered as the minimum size.

3. Only the sieve sizes given in the tables shall be considered in applying rules 1 and 2.

SIEVES FOR AGGREGATE TESTS

Square-mesh woven wire sieves

Sieve Number or Size	Size of Square Opening, Inches
100	0.0059
50	0.0117
30	0.0232
16	0.0469
8	0.094
4	0.187
⅜-in.	0.375
¾-in.	0.75
1 -in.	1.00
1½-in.	1.50
2 -in.	2.00
3 -in.	3.00

Sampling of Aggregates.—It is of utmost importance that representative samples of the aggregates be selected for test. Samples for sieve analyses should be selected by quartering or by the use of a sampler. For sieve analysis of fine aggregate a 500-g. sample should be used. The weight in grams of the sample for coarse aggregate should be about 3,000 times the maximum size of the particle measured in inches.

Cleanness of Aggregate.—It is assumed that the aggregates are clean, that is, free from injurious amounts of shale, alkali, organic matter and other deleterious substances. The test for organic impurities in sands may be made by digesting a sample in a 3-per cent solution of sodium hydroxide and observing the color of the super-

natant liquid. A dark color indicates the presence of such quantities of organic impurities that the sand should be rejected or subjected to rigid tests before use.

Slump Test.—The slump is used in the tables to denote the plasticity or workability of the concrete. The method of making this test is described in the "Tentative Specifications for Workability of Concrete for Concrete Pavements," of the American Society for Testing Materials, as follows:

In determining workability, the newly mixed concrete shall be placed in a truncated cone-shaped metal mold 12 in. high, 4 in. in diameter at the top and 8 in. in diameter at the base, and provided with handles at the sides. The concrete shall be lightly tamped with a rod as it is placed in the mold, which, when filled, shall be immediately removed and the slump or settlement of the concrete noted.

The slump is the settlement of the truncated cone of concrete from its original height of 12 in., measured in inches. The slump test should not be interpreted too strictly; in other words, a batch of concrete should not be rejected simply because the slump is slightly more than was intended. The principal value of the slump test is to avoid the habitual use of such an excess of mixing water as will materially lower the quality of the concrete. The specifications should indicate the workability of concrete desired for different types of construction. For the usual reinforced concrete work a slump of 6 to 7 in. should be aimed at; in mass work a slump of 1 to 4 in. may be used; for concrete roads in which finishing machines are used, a slump as low as 1 in. may be used.

Flow Test.—The apparatus for making the flow test for plasticity or workability consists of a metal-covered table with the top attached to the frame in such a way that it can be raised and dropped by means of a cam. The concrete is molded into a truncated cone 5 in. high, 6¾ in., top diameter and 10 in. bottom diameter. The test is made by lightly tamping the freshly mixed concrete into the mold on the table. After being filled, the mold is immediately withdrawn and the table raised and dropped ½ in. 15 times in about 10 sec. The base diameter of the mass of concrete after the test, expressed as a percentage of the original diameter, is the "flow."

Quantity of Mixing Water.—The quantity of mixing water required for a given slump or flow will vary with the mix, size and grading of

the aggregate, moisture content and absorption of aggregate. For average conditions the 1:1.7:3.4 mix for 2,000 lb. per square inch concrete, using O-No. 4 sand and No. 4-1½-in. pebbles, requires about 6¾ gal. of water per sack of cement for a 6- to 7-in. slump.

Comparison of Slump and Flow.—Concrete having a slump of 3 to 4 in. requires about 10 per cent more water than one having a slump of ½ to 1 in.; 6 to 7 in., 25 per cent more; and 8 to 10 in., 50 per cent more. Concrete having a slump of ½ to 1 in. will give a flow of about 160 to 180; 3- to 4-in. slump, a flow of 210 to 230; 6- to 7-in. slump, a flow of 250 to 270; 8- to 9-in. slump, a flow of 280 to 300.

CONCRETE TESTS FOR FIELD CONTROL

Specimens for compression tests of concrete for preliminary investigations or control tests during the progress of the work should be made in accordance with "Tentative Methods of Making Compression Tests of Concrete," or "Standard Method of Making and Storing Specimens of Concrete in the Field," of the American Society for Testing Materials. The following are the principal features of these methods:

Molding Specimens.—The specimens should be made in cylindrical metal forms having a height equal to twice the diameter (usually 6- by 12-in.). The concrete should be puddled into the molds in 3 equal layers by means of a ⅝-in. round rod pointed at the lower end.

Sampling Field Concrete.—Concrete for the test specimens should be taken immediately after it has been placed in the work. Concrete for each specimen should be taken from one place, and a sufficient number of samples taken at different points to give a fair average of the concrete placed in that part of the work.

Curing Test Cylinders.—About 48 hr. after molding, the specimens should be removed from the molds and buried in damp sand. Field specimens should remain buried until about 10 days prior to test, when they should be packed in damp sand or wet shavings and shipped to the laboratory, where they should be stored in a moist place until time of test.

Capping.—Before testing, the tops and bottoms of cylinders should be capped with a mixture of equal parts of cement and gypsum to insure an equal distribution of the load over the section.

Age at Test.—In general the specimens should be tested in a damp condition at the age of 28 days. The tables are based on tests at this age. A spherical bearing block should be used on top of the cylinders.

Mixing Concrete.—It is desirable that concrete be mixed at least 1 min. in a batch mixer of approved type after all materials are in the drum, or that a method of hand-mixing be used that will give similar results.

SUMMARY OF PRECAUTIONS TO BE OBSERVED IN THE USE OF TABLES

1. If the proportions to be used in the work are selected from the tables, without preliminary tests of the materials, and control tests are not made during the progress of the work, the mixtures in bold-faced type should be used.
2. Strengths were based on 28-day compression tests of 6- by 12-in. concrete cylinders puddled in the forms, cured in a damp place at normal temperatures and tested in a damp condition. Allowance must be made for lower strength resulting from temperatures below normal.
3. Portland cement should meet the requirements of the standard specifications.
4. Aggregate should be clean, structurally sound, and graded in size between the limits shown in the tables.
5. Concrete should be mixed at least 1 min. in a batch mixer of approved design.
6. In comparing the strengths of concrete specimens made on the work with the values in the tables, it is important that tests be made in accordance with standard methods.
7. The quantities of materials were based on measurements in the laboratory using dry materials rodded or puddled into the measure. No allowance was made for waste.
8. The slump test should not be too strictly interpreted.
9. Proportions and quantities of materials may be interpolated for concrete strengths, aggregate sizes and consistencies not covered by the tables.

Proportions for 1,500 Lb. per Square Inch Concrete

Based on 28-day compressive strength of 6- by 12-in. cylinders.
Proportions are expressed by volume as follows: Portland Cement: Fine Aggregate: Coarse Aggregate.
Thus 1:2.6:4.6 indicates 1 part by volume of portland cement, 2.6 parts by volume of fine aggregate and 4.6 parts by volume of coarse aggregate.

Size of coarse aggregate	Slump, in.	Proportions using fine aggregate of different sizes				
		0-No. 30	0-No. 16	0-No. 8	0-No. 4	0-⅜ in.
None	½ to 1	1:2.8	1:3.2	1:3.8	1:4.4	1:5.1
	3 to 4	1:2.4	1:2.8	1:3.3	1:3.8	1:4.5
	6 to 7	**1:1.9**	**1:2.2**	**1:2.6**	**1:3.0**	**1:3.6**
	8 to 10	1:1.4	1:1.6	1:1.8	1:2.1	1:2.5
No. 4 to ¾ in.	½ to 1	1:2.6:4.6	1:2.9:4.3	1:3.4:4.1	1:3.9:3.6	1:4.6:3.1
	3 to 4	1:2.3:4.0	1:2.6:3.8	1:2.9:3.6	1:3.4:3.2	1:4.1:2.8
	6 to 7	**1:1.8:3.4**	**1:2.0:3.2**	**1:2.3:3.1**	**1:2.6:2.8**	**1:3.1:2.5**
	8 to 10	1:1.1:2.5	1:1.3:2.4	1:1.5:2.4	1:1.7:2.2	1:2.1:2.0
No. 4 to 1 in.	½ to 1	1:2.4:5.3	1:2.7:5.2	1:3.1:5.0	1:3.5:4.7	1:4.3:4.3
	3 to 4	1:2.1:4.7	1:2.4:4.5	1:2.7:4.4	1:3.1:4.1	1:3.7:3.7
	6 to 7	**1:1.6:3.9**	**1:1.8:3.8**	**1:2.1:3.7**	**1:2.4:3.5**	**1:2.9:3.3**
	8 to 10	1:1.1:2.9	1:1.2:2.8	1:1.4:2.8	1:1.6:2.7	1:1.9:2.5
No. 4 to 1½ in.	½ to 1	1:2.4:6.0	1:2 7:5.9	1:3.1:5.8	1:3.5:5.4	1:4.1:5.1
	3 to 4	1:2.0:5.4	1:2.3:5.3	1:2.7:5.2	1:3.0:5.0	1:3.5:4.6
	6 to 7	**1:1.6:4.4**	**1:1.8:4.3**	**1:2.0:4.3**	**1:2.3:4.1**	**1:2.7:3.9**
	8 to 10	1:1.0:3.3	1:1.1:3.2	1:1.3:3.2	1:1.5:3.1	1:1.8:2.9
No. 4 to 2 in.	½ to 1	1:2.2:6.9	1:2.4:6.8	1:2.8:6.8	1:3.1:6.6	1:3.7:6.4
	3 to 4	1:1.8:6.2	1:2.0:6.1	1:2.4:6.1	1:2.7:6.0	1:3.1:5.7
	6 to 7	**1:1.4:5.1**	**1:1.6:5.0**	**1:1.8:5.0**	**1:2.0:5.0**	**1:2.4:4.8**
	8 to 10	1:0.9:3.8	1:1.0:3.8	1:1.1:3.8	1:1.3:3.8	1:1.5:3.7
⅜ to 1 in.	½ to 1	1:2.8:5.2	1:3.1:5.1	1:3.6:4.8	1:4.2:4.6	1:4.8:4.1
	3 to 4	1:2.4:4.5	1:2.6:4.5	1:3.1:4.3	1:3.6:4.0	1:4.1:3.6
	6 to 7	**1:1.9:3.9**	**1:2.1:3.7**	**1:2.4:3.6**	**1:2.8:3.4**	**1:3.2:3.1**
	8 to 10	1:1.3:2.8	1:1.4:2.8	1:1.6:2.7	1:1.9:2.6	1:2.2:2.4
⅜ to 1½ in.	½ to 1	1:2.8:5.8	1:3.1:5.7	1:3.5:5.5	1:4.1:5.3	1:4.7:4.9
	3 to 4	1:2.4:5.2	1:2.7:5.1	1:3.1:5.0	1:3.5:4.8	1:4.1:4.4
	6 to 7	**1:1.9:4.3**	**1:2.1:4.2**	**1:2.4:4.2**	**1:2.7:4.0**	**1:3.1:3.7**
	8 to 10	1:1.2:3.2	1:1.4:3.2	1:1.6:3.1	1:1.8:3.0	1:2.1:2.9
⅜ to 2 in.	½ to 1	1:2.7:6.6	1:3.0:6.6	1:3.4:6.5	1:3.9:6.4	1:4.4:6.0
	3 to 4	1:2.3:5.9	1:2.6:5.9	1:2.9:5.8	1:3.3:5.6	1:3.7:5.5
	6 to 7	**1:1.8:4.9**	**1:2.0:4.8**	**1:2.2:4.8**	**1:2.6:4.8**	**1:3.0:4.5**
	8 to 10	1:1.2:3.7	1:1.3:3.7	1:1.5:3.7	1:1.7:3.6	1:1.9:3.5
¾ to 1½ in.	½ to 1	1:3.2:5.4	1:3.6:5.3	1:4.1:5.1	1:4.7:4.8	1:5.3:4.4
	3 to 4	1:2.8:4.8	1:3.2:4.8	1:3.6:4.6	1:4.0:4.4	1:4.6:4.0
	6 to 7	**1:2.1:4.0**	**1:2.5:4.0**	**1:2.8:3.9**	**1:3.2:3.7**	**1:3.5:3.4**
	8 to 10	1:1.5:3.0	1:1.7:3.0	1:1.9:2.9	1:2.2:2.8	1:2.5:2.7
¾ to 2 in.	½ to 1	1:3.2:6.2	1:3.6:6.1	1:4.0:6.0	1:4.6:5.8	1:5.2:5.4
	3 to 4	1:2.8:5.5	1:3.1:5.5	1:3.5:5.4	1:3.9:5.2	1:4.5:4.9
	6 to 7	**1:2.1:4.5**	**1:2.4:4.6**	**1:2.7:4.5**	**1:3.1:4.4**	**1:3.5:4.1**
	8 to 10	1:1.4:3.4	1:1.6:3.4	1:1.8:3.4	1:2.1:3.4	1:2.4:3.3
¾ to 3 in.	½ to 1	1:3.2:7.1	1:3.6:7.1	1:4.0:7.0	1:4.6:6.9	1:5.2:6.6
	3 to 4	1:2.7:6.3	1:3.0:6.3	1:3.4:6.3	1:4.0:6.2	1:4.5:5.9
	6 to 7	**1:2.1:5.1**	**1:2.4:5.2**	**1:2.7:5.2**	**1:3.1:5.1**	**1:3.5:4.9**
	8 to 10	1:1.4:3.8	1:1.6:3.9	1:1.8:3.9	1:2.1:3.9	1:2.4:3.8

Quantities of Materials for 1 Cu. Yd. of 1,500 Lb. per Square Inch Concrete

The volume of cement is expressed in barrels and of aggregates in cubic yards.
F = fine aggregate; C = coarse aggregate.
Quantities are net, no allowance being made for waste; for average conditions, the following additions are suggested: Cement, 2 per cent; fine aggregate, 10 per cent, coarse aggregate, 5 per cent.

Size of coarse aggregate	Slump, in.	Quantities of materials using fine aggregate of different sizes															
		0-No. 30			0-No. 16			0-No. 8			0-No. 4			0-⅜ in.			
		Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	
None	½ to 1	1.90	.79		1.77	.84		160	.90		1.36	.89		1.27	.96		
	3 to 4	2.12	.75		1.96	.81		1.75	.86		1.52	.86		1.38	.92		
	6 to 7	**2.49**	**.70**		**2.33**	**.76**		**2.08**	**.80**		**1.81**	**.80**		**1.64**	**.88**		
	8 to 10	2.98	.62		2.82	.67		2.36	.70		2.32	.72		2.10	.78		
No. 4 to ¾ in.	½ to 1	1.02	.39	.69	1.02	.44	.66	1.01	.51	.61	.98	.56	.52	.98	.67	.45	
	3 to 4	1.17	.40	.69	1.12	.43	.63	1.11	.48	.59	1.07	.54	.51	1.08	.65	.45	
	6 to 7	**1.39**	**.37**	**.70**	**1.36**	**.40**	**.64**	**1.31**	**.45**	**.60**	**1.30**	**.50**	**.54**	**1.27**	**.58**	**.47**	
	8 to 10	1.76	.29	.65	1.76	.34	.63	1.73	.38	.61	1.68	.42	.55	1.67	.52	.49	
No. 4 to 1 in.	½ to 1	.98	.35	.77	.98	.39	.75	.96	.44	.71	.94	.49	.65	.93	.59	.59	
	3 to 4	1.08	.34	.75	1.06	.38	.70	1.05	.42	.68	1.02	.47	.62	1.02	.56	.56	
	6 to 7	**1.32**	**.31**	**.76**	**1.30**	**.35**	**.73**	**1.23**	**.38**	**.67**	**1.21**	**.43**	**.63**	**1.21**	**.52**	**.59**	
	8 to 10	1.70	.28	.73	1.68	.30	.70	1.64	.34	.68	1.60	.38	.64	1.57	.44	.58	
No. 4 to 1½ in.	½ to 1	.93	.33	.83	.93	.37	.81	.91	.42	.78	.88	.46	.70	.86	.52	.65	
	3 to 4	1.02	.30	.81	1.03	.35	.81	1.01	.40	.78	.98	.43	.72	.97	.50	.66	
	6 to 7	**1.24**	**.29**	**.81**	**1.23**	**.33**	**.78**	**1.18**	**.35**	**.75**	**1.12**	**.38**	**.68**	**1.15**	**.46**	**.66**	
	8 to 10	1.62	.24	.79	1.59	.26	.75	1.54	.30	.73	1.50	.33	.69	1.50	.40	.64	
No. 4 to 2 in.	½ to 1	.88	.29	.90	.88	.31	.88	.85	.35	.86	.82	.38	.80	.80	.44	.76	
	3 to 4	.98	.26	.90	.99	.29	.89	.96	.34	.87	.93	.37	.82	.91	.42	.77	
	6 to 7	**1.17**	**.27**	**.88**	**1.16**	**.28**	**.86**	**1.13**	**.30**	**.84**	**1.09**	**.32**	**.81**	**1.09**	**.39**	**.78**	
	8 to 10	1.53	.20	.86	1.49	.22	.84	1.46	.24	.82	1.43	.27	.80	1.43	.32	.78	
⅜ to 1 in.	½ to 1	1.00	.41	.77	.97	.44	.73	.95	.51	.68	.91	.56	.62	.92	.65	.56	
	3 to 4	1.08	.38	.72	1.05	.40	.70	1.03	.47	.65	1.00	.53	.59	1.02	.62	.54	
	6 to 7	**1.32**	**.37**	**.75**	**1.27**	**.40**	**.70**	**1.25**	**.44**	**.67**	**1.20**	**.50**	**.60**	**1.21**	**.57**	**.56**	
	8 to 10	1.73	.33	.72	1.69	.35	.70	1.66	.39	.66	1.59	.45	.61	1.54	.50	.55	
⅜ to 1½ in	½ to 1	.93	.38	.80	.91	.42	.77	.90	.47	.73	.85	.52	.67	.85	.59	.62	
	3 to 4	1.03	.37	.79	1.01	.40	.76	1.00	.46	.74	.95	.49	.68	.96	.58	.62	
	6 to 7	**1.22**	**.34**	**.78**	**1.21**	**.38**	**.75**	**1.18**	**.42**	**.73**	**1.17**	**.47**	**.69**	**1.13**	**.52**	**.62**	
	8 to 10	1.62	.29	.77	1.60	.33	.76	1.54	.36	.71	1.48	.39	.66	1.46	.45	.63	
⅜ to 2 in.	½ to 1	.88	.35	.86	.86	.38	.84	.83	.42	.80	.79	.45	.75	.77	.50	.68	
	3 to 4	.98	.33	.85	.97	.37	.85	.95	.41	.81	.91	.44	.75	.90	.49	.73	
	6 to 7	**1.16**	**.31**	**.84**	**1.14**	**.34**	**.81**	**1.11**	**.36**	**.79**	**1.08**	**.42**	**.77**	**1.07**	**.48**	**.71**	
	8 to 10	1.51	.28	.87	1.50	.29	.82	1.45	.32	.79	1.40	.35	.75	1.38	.39	.71	
¾ to 1½ in.	½ to 1	.91	.43	.73	.89	.47	.70	.87	.53	.66	.82	.57	.58	.81	.63	.53	
	3 to 4	1.00	.41	.71	1.00	.47	.71	.97	.52	.66	.93	.55	.60	.91	.62	.54	
	6 to 7	**1.20**	**.37**	**.71**	**1.20**	**.44**	**.71**	**1.15**	**.48**	**.66**	**1.11**	**.53**	**.61**	**1.08**	**.56**	**.54**	
	8 to 10	1.60	.36	.71	1.57	.39	.70	1.52	.43	.65	1.44	.47	.60	1.43	.53	.57	
¾ to 2 in.	½ to 1	.85	.40	.78	.85	.45	.77	.80	.47	.71	.76	.52	.65	.74	.57	.59	
	3 to 4	.96	.40	.78	.95	.44	.77	.92	.48	.73	.84	.48	.65	.86	.57	.62	
	6 to 7	**1.14**	**.35**	**.76**	**1.14**	**.41**	**.78**	**1.08**	**.43**	**.72**	**1.03**	**.47**	**.67**	**1.04**	**.54**	**.63**	
	8 to 10	1.50	.31	.75	1.46	.35	.73	1.43	.38	.72	1.37	.43	.69	1.34	.48	.65	
¾ to 3 in.	½ to 1	.78	.37	.82	.76	.40	.80	.72	.43	.75	.67	.46	.68	.65	.50	.63	
	3 to 4	.91	.36	.85	.89	.40	.83	.86	.43	.80	.81	.48	.74	.79	.53	.69	
	6 to 7	**1.04**	**.32**	**.79**	**1.04**	**.37**	**.80**	**1.03**	**.41**	**.79**	**.98**	**.45**	**.88**	**.99**	**.51**	**.72**	
	8 to 10	1.43	.30	.80	1.39	.33	.80	1.35	.36	.78	1.30	.40	.75	1.25	.44	.70	

Proportions for 2,000 Lb. per Square Inch Concrete

Based on 28-day compressive strength of 6- by 12-in. cylinders.
Proportions are expressed by volume as follows: Portland Cement: Fine Aggregate: Coarse Aggregate.
Thus 1:2.6:4.6 indicates 1 part by volume of portland cement, 2.6 parts by volume of fine aggregate and 4.6 parts by volume of coarse aggregate.

Size of coarse aggregate	Slump, in.	Proportions using fine aggregate of different sizes				
		0-No. 30	0-No. 16	0-No. 8	0-No. 4	0-⅜ in.
None	½ to 1	1:2.2	1:2.6	1:3.0	1:3 5	1:4.1
	3 to 4	1:1.9	1:2.2	1:2.6	1:3.0	1:3.5
	6 to 7	**1:1.5**	**1:1.7**	**1:2.0**	**1:2.3**	**1:2.7**
	8 to 10	1:1.0	1:1.1	1:1.3	1:1.6	1:1.8
No. 4 to ¾ in.	½ to 1	1:2.1:3.8	1:2.3:3.7	1:2.6:3.5	1:3.0:3.1	1:3.6:2.8
	3 to 4	1:1.7:3.3	1:1.9:3.2	1:2.2:3.1	1:2.6:2.8	1:3.0:2.4
	6 to 7	**1:1.3:2.7**	**1:1.4:2.6**	**1:1.7:2.5**	**1:1.9:2.3**	**1:2 3:2.1**
	8 to 10	1:0.8:1.9	1:0.9:1.9	1:1.0:1.8	1:1.2:1.7	1:1.5:1.6
No. 4 to 1 in.	½ to 1	1:1.9:4.5	1:2.2:4.3	1:2.5:4.2	1:2.8:3.9	1:3.4:3.6
	3 to 4	1:1.6:3.9	1:1.8:3.8	1:2.1:3.7	1:2.4:3.5	1:2.8:3.2
	6 to 7	**1:1.2:3.1**	**1:1.3:3.1**	**1:1.5:3.0**	**1:1.8:2.9**	**1:2.1:2.7**
	8 to 10	1:0.7:2.2	1:0.8:2.2	1:1.0:2.3	1:1.1:2.1	1:1.3:2.0
No. 4 to 1½ in.	½ to 1	1:1.9:5.0	1:2.1:4.9	1:2.4:4.9	1:2.7:4.6	1:3.2:4.4
	3 to 4	1:1.6:4.4	1:1.7:4.3	1:2.0:4.2	1:2.4:4.0	1:2.7:3.8
	6 to 7	**1:1 1:3.5**	**1:1.3:3.5**	**1:1.4:3.5**	**1:1 7:3.4**	**1:2.0:3.2**
	8 to 10	1:0.7:2 5	1:0.8:2.5	1:0.9:2.5	1:1.0:2.4	1:1.2:2.3
No. 4 to 2 in.	½ to 1	1:1.7:5.8	1:1.9:5.7	1:2.1:5.8	1:2.4:5.6	1:2.8:5.5
	3 to 4	1:1.4:5.0	1:1.5:5.0	1:1.8:5.0	1:2.0:4 9	1:2.3:4.7
	6 to 7	**1:1.0:4.1**	**1:1.1:4.1**	**1:1.2:4.1**	**1:1.4:4.1**	**1:1.7:3.9**
	8 to 10	1:0.6:2.9	1:0.7:2.9	1:0.7:3.0	1:0.8:2.9	1:1.0:2.9
⅜ to 1 in.	½ to 1	1:2.2:4.4	1:2.5:4.2	1:2.8:4.1	1:3.3:3.8	1:3.8:3.4
	3 to 4	1:1.9:3.8	1:2.1:3.7	1:2.4:3.6	1:2.8:3 4	1:3.2:3.1
	6 to 7	**1:1.4:3.1**	**1:1.5:3.0**	**1:1.8:3.0**	**1:2.1:2 8**	**1:2 4:2.5**
	8 to 10	1:0.9:2.2	1:1.0:2.2	1:1.1:2.2	1:1.3:2.0	1:1.5:1.9
⅜ to 1½ in.	½ to 1	1:2.2:4.9	1:2.5:4.8	1:2.8:4.7	1:3.2:4 6	1:3.7:4.2
	3 to 4	1:1.9:4 3	1:2.1:4.2	1:2.4:4 1	1:2.7:4 0	1:3.1:3.7
	6 to 7	**1:1.4:3 5**	**1:1.5:3.4**	**1:1.7:3 4**	**1:2 0:3.3**	**1:2.3:3.1**
	8 to 10	1:0.9:2.5	1:1.0:2.5	1:1.1:2.4	1:1.3:2.4	1:1.5:2.3
⅜ to 2 in.	½ to 1	1:2.1:5.6	1:2.3:5.5	1:2.6:5.5	1:3.0:5.4	1:3.5:5.1
	3 to 4	1:1.7:4 8	1:2.0:4.8	1:2.2:4.8	1:2.5:4.7	1:2.9:4 4
	6 to 7	**1:1.3:4.0**	**1:1.4:3.9**	**1:1.6:3.9**	**1:1.8:3.9**	**1:2 1:3.8**
	8 to 10	1:0.8:2.9	1:0.9:2.9	1:1.0:2.9	1:1.2:2.9	1:1.3:2.8
¾ to 1½ in.	½ to 1	1:2.6:4.5	1:2.9:4.5	1:3.3:4.4	1:3.8:4.2	1:4.3:3.9
	3 to 4	1:2.2:3.9	1:2.5:3.9	1:2.8:3.8	1:3.2:3.6	1:3.6:3.3
	6 to 7	**1:1.6:3.2**	**1:1.8:3.2**	**1:2.1:3.1**	**1:2.4:3.0**	**1:2.7:2.8**
	8 to 10	1:1.0:2.3	1:1.2:2.3	1:1.4:2.2	1:1.6:2.2	1:1.8:2.1
¾ to 2 in.	½ to 1	1:2.5:5.2	1:2.8:5.2	1:3.2:5.1	1:3.6:5.0	1:4.1:4.7
	3 to 4	1:2.1:4.5	1:2.4:4.5	1:2.7:4.4	1:3.1:4.3	1:3.5:4.0
	6 to 7	**1:1.6:3 7**	**1:1.8:3.7**	**1:2.0:3 7**	**1:2.3:3.6**	**1:2.6:3.5**
	8 to 10	1:1.0:2.6	1:1.1:2.7	1:1.3:2.6	1:1.5:2.7	1:1.7:2.6
¾ to 3 in.	½ to 1	1:2.5:6.0	1:2.9:5.9	1:3.2:5.9	1:3.6:5.8	1:4.1:5.6
	3 to 4	1:2.1:5.1	1:2.4:5 2	1:2.7:5 2	1:3.1:5 1	1:3.5:4.9
	6 to 7	**1:1 5:4.1**	**1:1.7:4 2**	**1:2.0:4.2**	**1:2.3:4.2**	**1:2.5:4.0**
	8 to 10	1:1.0:2.9	1:1.1:3.0	1:1.3:3.0	1:1.5:3.0	1:1.7:3.0

Quantities of Materials for 1 Cu. Yd. of 2,000 Lb. per Square Inch Concrete

The volume of cement is expressed in barrels and of aggregates in cubic yards.
F = fine aggregate; C = coarse aggregate.
Quantities are net, no allowance being made for waste; for average conditions, the following additions are suggested: Cement, 2 per cent; fine aggregate, 10 per cent; coarse aggregate, 5 per cent.

Size of coarse aggregate	Slump, in.	Quantities of materials using fine aggregate of different sizes															
		0-No. 30			0-No. 16			0-No. 8			0-No. 4			0-⅜ in.			
		Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	
None	½ to 1	2.31	.75		2.12	.82		1.92	.85		1.65	.85		1.42	.86		
	3 to 4	2.55	.72		2.39	.78		2 12	.82		1.85	.82		1.71	.89		
	6 to 7	**2 94**	**.65**		**2 83**	**.71**		**2 52**	**.75**		**2.24**	**.76**		**2.06**	**.83**		
	8 to 10	3.60	.53		3.54	.58		3.25	.62		2.80	.66		2.62	.70		
No. 4 to ¾ in.	½ to 1	1.27	.40	.71	1.24	.42	.68	1.19	.46	.62	1.17	.52	.54	1.17	.62	.48	
	3 to 4	1.43	.36	.70	1 40	.39	.66	1.36	.44	.62	1.34	.51	.56	1.32	.59	.47	
	6 to 7	**1 71**	**.33**	**.68**	**1.70**	**.35**	**.66**	**1.66**	**.42**	**.61**	**1.60**	**.45**	**.54**	**1.59**	**.54**	**.50**	
	8 to 10	2.25	.27	.63	2.23	.30	.63	2.20	.33	.59	2.13	.38	.54	2.10	.47	.50	
No. 4 to 1 in.	½ to 1	1.19	.33	.79	1.17	.38	.74	1.13	.42	.70	1.10	.46	.64	1.09	.55	.58	
	3 to 4	1.36	.32	.78	1.32	.35	.74	1.26	.39	.69	1.24	.44	.64	1.24	.51	.59	
	6 to 7	**1 65**	**.29**	**.76**	**1.62**	**.31**	**.74**	**1.56**	**.35**	**.69**	**1.52**	**.40**	**.65**	**1.51**	**.47**	**.60**	
	8 to 10	2.15	.22	.70	2.13	.25	.69	2.07	.31	.70	2.01	.33	.63	1.98	.38	.59	
No. 4 to 1½ in.	½ to 1	1.10	.31	.81	1.09	.34	.79	1.07	.38	.78	1.05	.42	.71	1.04	.49	.68	
	3 to 4	1.26	.30	.82	1.25	.31	.79	1.20	.35	.74	1.17	.42	.69	1.16	.46	.65	
	6 to 7	**1.54**	**.25**	**.80**	**1.52**	**.29**	**.79**	**1.47**	**.30**	**.76**	**1.44**	**.36**	**.72**	**1.43**	**.42**	**.68**	
	8 to 10	2.04	.21	.75	2.00	.24	.74	1.94	.26	.72	1.88	.28	.67	1.88	.33	.64	
No. 4 to 2 in.	½ to 1	1.04	.26	.89	1.05	.29	.88	1.04	.32	.89	1.00	.35	.83	.98	.41	.80	
	3 to 4	1 20	.25	.89	1.19	.26	.88	1.16	.31	.86	1.11	.33	.80	1.12	.38	.78	
	6 to 7	**1.47**	**.22**	**.89**	**1.45**	**.24**	**.88**	**1.38**	**.25**	**.84**	**1.35**	**.28**	**.82**	**1.36**	**.34**	**.79**	
	8 to 10	1.92	.17	.82	1.89	.20	.81	1.85	.19	.82	1.81	.21	.78	1.80	.27	.77	
⅜ to 1 in.	½ to 1	1.17	.38	.76	1.16	.43	.72	1.12	.46	.68	1.10	.54	.62	1.10	.62	.55	
	3 to 4	1.34	.38	.75	1.33	.41	.73	1.29	.46	.69	1.23	.51	.62	1.23	.58	.56	
	6 to 7	**1.67**	**.35**	**.77**	**1.63**	**.36**	**.72**	**1.57**	**.42**	**.70**	**1.51**	**.47**	**.63**	**1.53**	**.54**	**.57**	
	8 to 10	2.16	.29	.70	2.12	.31	.69	2.06	.34	.67	2.01	.39	.60	1.93	.43	.54	
⅜ to 1½ in.	½ to 1	1.10	.36	.80	1.07	.40	.76	1.05	.43	.73	1.02	.48	.69	1.03	.56	.64	
	3 to 4	1.25	.35	.79	1.24	.39	.77	1.21	.43	.73	1.16	.46	.69	1.15	.53	.63	
	6 to 7	**1.54**	**.32**	**.80**	**1.52**	**.34**	**.77**	**1.47**	**.37**	**.74**	**1.42**	**.42**	**.69**	**1.41**	**.48**	**.65**	
	8 to 10	2.05	.27	.76	2.00	.29	.74	1.93	.31	.70	1.89	.36	.67	1.83	.41	.62	
⅜ to 2 in.	½ to 1	1.05	.33	.85	1.03	.35	.84	1.01	.39	.82	.98	.43	.78	.97	.50	.73	
	3 to 4	1.19	.30	.85	1.18	.35	.84	1.14	.37	.81	1.10	.41	.76	1.09	.47	.71	
	6 to 7	**1.46**	**.28**	**.86**	**1.45**	**.30**	**.84**	**1.40**	**.33**	**.81**	**1.33**	**.35**	**.77**	**1.31**	**.41**	**.74**	
	8 to 10	1.91	.23	.82	1.88	.25	.81	1.83	.27	.79	1.80	.32	.77	1.74	.34	.72	
¾ to 1½ in.	½ to 1	1.07	.41	.71	1.06	.45	.71	1.02	.50	.66	.98	.55	.61	.98	.62	.57	
	3 to 4	1.23	.40	.71	1.23	.45	.71	1.19	.49	.67	1 12	.53	.60	1 10	.59	.54	
	6 to 7	**1.51**	**.36**	**.72**	**1.49**	**.40**	**.71**	**1.45**	**.45**	**.67**	**1.36**	**.48**	**.60**	**1.36**	**.54**	**.56**	
	8 to 10	2.01	.30	.69	1.97	.35	.67	1.91	.40	.62	1.81	.43	.59	1.79	.48	.56	
¾ to 2 in.	½ to 1	1.02	.38	.79	1.02	.42	.78	.99	.47	.75	.94	.50	.70	.93	.56	.65	
	3 to 4	1.17	.36	.78	1.16	.41	.77	1.11	.44	.72	1.05	.48	.67	1.04	.54	.61	
	6 to 7	**1.44**	**.34**	**.79**	**1.41**	**.38**	**.77**	**1.37**	**.41**	**.75**	**1.31**	**.45**	**.70**	**1.26**	**.48**	**.65**	
	8 to 10	1.88	.28	.72	1.85	.30	.74	1.82	.35	.70	1.74	.39	.69	1.70	.43	.65	
¾ to 3 in.	½ to 1	.96	.36	.85	.95	.41	.83	.92	.44	.80	.88	.47	.75	.86	.52	.71	
	3 to 4	1.08	.34	.81	1 08	.38	.83	1.05	.42	.81	1.00	.46	.76	.98	.51	.71	
	6 to 7	**1.36**	**.30**	**.83**	**1.30**	**.33**	**.81**	**1.28**	**.38**	**.80**	**1 23**	**.42**	**.77**	**1 20**	**.44**	**.71**	
	8 to 10	1.81	.27	.78	1.76	.29	.78	1.72	.33	.76	1 65	.37	.73	1 60	.40	.71	

Proportions for 2,500 Lb. per Square Inch Concrete

Based on 28-day compressive strength of 6- by 12-in. cylinders.
Proportions are expressed by volume as follows: Portland Cement : Fine Aggregate : Coarse Aggregate.
Thus 1:2.6:4.6 indicates 1 part by volume of portland cement, 2.6 parts by volume of fine aggregate and 4.6 parts by volume of coarse aggregate.

Size of coarse aggregate	Slump, in.	Proportions using fine aggregate of different sizes				
		0-No. 30	0-No. 16	0-No. 8	0-No. 4	0-⅜ in.
None	½ to 1	1:1.8	1:2.1	1:2.4	1:2.9	1:3.3
	3 to 4	1:1.5	1:1.8	1:2.1	1:2.4	1:2.8
	6 to 7	**1:1.1**	**1:1.3**	**1:1.6**	**1:1.8**	**1:2.1**
	8 to 10	1:0.7	1:0.8	1:0.9	1:1.1	1:1.3
No. 4 to ¾ in.	½ to 1	1:1.6:3.2	1:1.8:3.1	1:2.1:3.0	1:2.4:2.7	1:2.9:2.4
	3 to 4	1:1.3:2.8	1:1.5:2.7	1:1.7:2.6	1:2 0:2.4	1:2.4:2.2
	6 to 7	**1:1.0:2.2**	**1:1.1:2.2**	**1:1.3:2.1**	**1:1.5:2.0**	**1:1.8:1.8**
	8 to 10	1.0.5:1.4	1:0.6:1.4	1:0.7:1.4	1:0.8:1.4	1:1.0:1.3
No. 4 to 1 in.	½ to 1	1:1.5:3.7	1:1.7:3.7	1:2.0:3.5	1:2.2:3.4	1:2.7:3.1
	3 to 4	1:1.2:3.3	1:1.4:3.2	1:1.6:3.1	1:1 9:3.0	1:2.2:2.7
	6 to 7	**1:0.9:2.6**	**1:1.0:2.5**	**1:1.1:2.5**	**1:1.3:2.4**	**1:1.6:2.3**
	8 to 10	1:0.5:1.7	1:0.6:1.7	1:0.6:1.7	1:0.7:1.6	1:0.9:1.5
No. 4 to 1½ in.	½ to 1	1:1.4:4.2	1:1.6:4.1	1:1.9:4.1	1:2.2:4.0	1:2.5:3.8
	3 to 4	1:1.2:3.7	1:1.3:3.6	1:1.5:3.6	1:1.8:3.5	1:2.1:3.3
	6 to 7	**1:0.9:2.9**	**1:0.9:2.8**	**1:1.1:2.8**	**1:1.3:2.8**	**1:1.5:2.6**
	8 to 10	1:0.5:1.9	1:0.5:1.9	1:0.6:1.9	1:0.7:1.8	1:0.8:1.8
No. 4 to 2	½ to 1	1:1.3:4.9	1:1.4:4.8	1:1.6:4.9	1:1.9:4.8	1:2.2:4.7
	3 to 4	1:1.1:4.3	1:1.2:4.2	1:1.3:4.3	1:1.6:4.2	1:1.8:4.1
	6 to 7	**1:0.7:3.3**	**1:0.8:3.3**	**1:0.9:3.4**	**1:1.1:3.3**	**1:1.2:3.3**
	8 to 10	1:0.4:2.2	1:0.4:2.2	1:0.5:2.2	1:0.6:2.2	1:0.6:2.2
⅜ to 1 in.	½ to 1	1:1.8:3.7	1:2.0:3.6	1:2.3:3.5	1:2.6:3.3	1:3.0:2.9
	3 to 4	1:1.4:3.2	1:1.6:3.1	1:1.9:2.9	1:2.2:2.9	1:2.5:2.6
	6 to 7	**1:1.0:2.5**	**1:1.2:2.5**	**1:1.3:2.4**	**1:1.6:2.3**	**1:1.8:2 2**
	8 to 10	1:0.6:1.6	1:0.7:1.6	1:0.8:1.6	1:0.9:1.6	1:1.0:1.5
⅜ to 1½ in.	½ to 1	1:1.7:4.1	1:1.9:4.1	1:2.2:4.0	1:2.5:3.9	1:2.9:3.6
	3 to 4	1:1.5:3.6	1:1.6:3.6	1:1.8:3.5	1:2.1:3.4	1:2.3 3.2
	6 to 7	**1:1.0:2.9**	**1:1.2:2.8**	**1:1.3:2.8**	**1:1.5:2.7**	**1:1.8:2.6**
	8 to 10	1:0.6:1.9	1:0.6:1.9	1:0.8:1.8	1:0.9:1.8	1:1.0:1.8
⅜ to 2 in.	½ to 1	1:1.7:4.7	1:1.8:4.7	1:2.1:4.7	1:2.4:4.6	1:2.7:4.4
	3 to 4	1:1.4:4.1	1:1.5:4.1	1:1.7:4.1	1:2.0:4.0	1:2.3:3.9
	6 to 7	**1:1.0:3.2**	**1:1.1:3.2**	**1:1.2:3.2**	**1:1.4:3.2**	**1:1.6:3.1**
	8 to 10	1:0.5:2.1	1:0.6:2.1	1:0.7:2.2	1:0.8:2.2	1:0.9:2.1
¾ to 1½ in.	½ to 1	1:2.0:3.8	1:2.3:3.8	1:2.6:3.7	1:3.0:3.6	1:3.4:3.3
	3 to 4	1:1.7:3.3	1:2.0:3.3	1:2.2:3.2	1:2.5:3.2	1:2.9:2.9
	6 to 7	**1:1.2:2.6**	**1:1.4:2.6**	**1:1.6:2.6**	**1:1.9:2.5**	**1:2.1:2.3**
	8 to 10	1:0.7:1.7	1:0.8:1.7	1:0.9:1.7	1:1.1:1.7	1:1.2:1.6
¾ to 2 in.	½ to 1	1:2.0:4.4	1:2.2:4.4	1:2.5:4.3	1:2.9:4.3	1:3.3:4.1
	3 to 4	1:1.7:3.8	1:1.9:3.8	1:2 1:3.8	1:2.5:3.7	1:2.8:3.6
	6 to 7	**1:1.2:3.0**	**1:1.4:3.0**	**1:1.5:3.0**	**1:1.8:3.0**	**1:2.0:2.8**
	8 to 10	1:0.7:2.0	1:0.8:2.0	1:0.9:2.0	1:1.0:2.0	1:1.2:2.0
¾ to 3 in.	½ to 1	1:2.0:5.0	1:2.2:5.0	1:2.5:5.0	1:2.7:5.0	1:3.2:4.7
	3 to 4	1:1.7:4.3	1:1.9:4.3	1:2.1:4.3	1:2.4:4.3	1:2.7:4.1
	6 to 7	**1:1.2:3.3**	**1:1.4:3.4**	**1:1.5:3.4**	**1:1 8:3 4**	**1:2.0:3.3**
	8 to 10	1:0.7:2.2	1:0.8:2.2	1:0.9:2.2	1:1.0:2.3	1:1.2:2.3

Quantities of Materials for 1 Cu. Yd. of 2,500 Lb. per Square Inch Concrete

The volume of cement is expressed in barrels and of aggregates in cubic yards.
F = fine aggregate; C = coarse aggregate.
Quantities are net, no allowance being made for waste; for average conditions, the following additions are suggested: Cement, 2 per cent; fine aggregate, 10 per cent; coarse aggregate, 5 per cent.

Size of coarse aggregate	Slump, in.	Quantities of materials using fine aggregate of different sizes															
		0-No. 30			0-No. 16			0-No. 8			0-No. 4			0-⅜ in.		
		Cement	Aggregate F.	C.	Cement	Aggregate F.	C.	Cement	Aggregate F.	C.	Cement	Aggregate F.	C.	Cement	Aggregate F.	C.
None	½ to 1	2.71	.72		2.53	.79		2.30	.82		1.94	.83		1.83	.89	
	3 to 4	3.01	.67		2.78	.74		2.50	.78		2.20	.78		2.05	.85	
	6 to 7	**3.60**	**.59**		**3.38**	**.65**		**2.97**	**.70**		**2.71**	**.72**		**2.45**	**.76**	
	8 to 10	4.24	.44		4.11	.49		3.91	.52		3.46	.56		3.16	.61	
No. 4 to ¾ in.	½ to 1	1.49	.35	.70	1.46	.39	.67	1.42	.44	.63	1.39	.49	.55	1.39	.60	.49
	3 to 4	1.68	.32	.70	1.67	.37	.67	1.63	.41	.63	1.57	.46	.56	1.54	.55	.50
	6 to 7	**2.06**	**.30**	**.67**	**2.03**	**.33**	**.66**	**1.98**	**.38**	**.62**	**1.89**	**.42**	**.56**	**1.89**	**.50**	**.50**
	8 to 10	2.83	.21	.59	2.78	.25	.58	2.71	.28	.56	2.64	.31	.55	2.58	.38	.50
No. 4 to 1 in	½ to 1	1.42	.32	.78	1.39	.35	.76	1.35	.40	.70	1.30	.42	.65	1.29	.51	.59
	3 to 4	1.61	.29	.79	1.56	.32	.74	1.51	.36	.69	1.48	.41	.65	1.47	.48	.59
	6 to 7	**1.95**	**.26**	**.75**	**1.90**	**.28**	**.70**	**1.87**	**.30**	**.69**	**1.82**	**.35**	**.65**	**1.81**	**.43**	**.62**
	8 to 10	2.68	.19	.65	2.64	.23	.66	2.54	.23	.64	2.50	.26	.59	2.58	.33	.55
No. 4 to 1½ in.	½ to 1	1.34	.27	.83	1.32	.31	.80	1.25	.35	.76	1.23	.40	.73	1.23	.45	.69
	3 to 4	1.50	.27	.82	1.48	.28	.79	1.43	.32	.76	1.39	.37	.72	1.39	.43	.68
	6 to 7	**1.83**	**.24**	**.79**	**1.83**	**.24**	**.76**	**1.78**	**.29**	**.74**	**1.73**	**.33**	**.72**	**1.72**	**.38**	**.66**
	8 to 10	2.50	.19	.70	2.49	.18	.70	2.42	.21	.68	2.40	.25	.64	2.39	.28	.64
No. 4 to 2 in.	½ to 1	1.25	.24	.91	1.24	.26	.88	1.21	.29	.88	1.17	.33	.83	1.13	.37	.79
	3 to 4	1.44	.23	.92	1.41	.25	.88	1.36	.26	.87	1.31	.31	.81	1.32	.35	.80
	6 to 7	**1.77**	**.18**	**.87**	**1.75**	**.21**	**.86**	**1.70**	**.23**	**.86**	**1.65**	**.27**	**.81**	**1.63**	**.29**	**.80**
	8 to 10	2.43	.14	.79	2.42	.14	.79	2.38	.18	.78	2.32	.21	.75	2.31	.20	.75
⅜ to 1 in.	½ to 1	1.41	.38	.77	1.39	.41	.74	1.34	.46	.69	1.29	.50	.63	1.29	.57	.55
	3 to 4	1.61	.33	.76	1.57	.37	.72	1.51	.42	.65	1.47	.48	.63	1.45	.54	.56
	6 to 7	**1.97**	**.29**	**.73**	**1.91**	**.34**	**.71**	**1.87**	**.36**	**.66**	**1.83**	**.43**	**.62**	**1.78**	**.47**	**.58**
	8 to 10	2.64	.23	.62	2.62	.27	.62	2.56	.30	.61	2.47	.33	.58	2.42	.36	.54
⅜ to 1½ in.	½ to 1	1.32	.33	.80	1.30	.37	.79	1.27	.41	.75	1.22	.45	.70	1.21	.52	.64
	3 to 4	1.49	.33	.79	1.48	.35	.79	1.43	.38	.74	1.38	.43	.69	1.37	.47	.65
	6 to 7	**1.86**	**.28**	**.80**	**1.83**	**.33**	**.76**	**1.77**	**.34**	**.74**	**1.73**	**.38**	**.69**	**1.68**	**.45**	**.65**
	8 to 10	2.49	.22	.70	2.46	.22	.69	2.41	.29	.64	2.38	.32	.63	2.32	.34	.62
⅜ to 2 in.	½ to 1	1.24	.31	.86	1.23	.33	.85	1.09	.34	.76	1.15	.41	.78	1.12	.45	.73
	3 to 4	1 41	.29	.85	1.40	.31	.85	1 35	.34	.82	1.29	.38	.76	1.28	.44	.74
	6 to 7	**1.77**	**.26**	**.84**	**1.74**	**.28**	**.82**	**1.68**	**.30**	**.80**	**1.62**	**.34**	**.77**	**1.58**	**.38**	**.73**
	8 to 10	2 41	.18	.75	2.37	.21	.74	2.32	.24	.76	2.30	.27	.75	2.22	.30	.69
¾ to 1½ in.	½ to 1	1.30	.38	.73	1.29	.44	.72	1.21	.47	.66	1.18	.52	.63	1.16	.58	.57
	3 to 4	1.47	.37	.72	1.45	.43	.71	1.40	.46	.66	1.35	.50	.64	1 32	.57	.57
	6 to 7	**1.80**	**.32**	**.69**	**1.80**	**.37**	**.69**	**1.75**	**.42**	**.67**	**1.67**	**.47**	**.62**	**1.64**	**.51**	**.56**
	8 to 10	2.48	.26	.63	2.45	.29	.62	2.40	.32	.60	2.31	.38	.58	2.27	.40	.54
¾ to 2 in.	½ to 1	1.22	.36	.79	1.22	.40	.79	1.18	.44	.75	1.10	.47	.70	1.07	.52	.65
	3 to 4	1.41	.35	.79	1.38	.39	.77	1.33	.41	.75	1 27	.47	.69	1.23	.51	.65
	6 to 7	**1.74**	**.31**	**.77**	**1.70**	**.35**	**.76**	**1.66**	**.37**	**.74**	**1.58**	**.42**	**.70**	**1.53**	**.45**	**.64**
	8 to 10	2.40	.25	.71	2.36	.28	.70	2.29	.31	.68	2.22	.33	.66	2.17	.38	.64
¾ to 3 in.	½ to 1	1.15	.34	.85	1.13	.37	.84	1.10	.41	.81	1.05	.42	.78	1.02	.48	.71
	3 to 4	1.33	.33	.84	1.30	.37	.83	1.25	.39	.79	1.21	.43	.77	1 18	.47	.72
	6 to 7	**1.67**	**.30**	**.82**	**1 59**	**.33**	**.80**	**1.55**	**.34**	**.78**	**1 49**	**.40**	**.75**	**1 45**	**.43**	**.71**
	8 to 10	2.32	.24	.75	2.27	.27	.74	2.20	.29	.72	2.13	.32	.73	2.12	.38	.72

Proportions for 3,000 Lb. per Square Inch Concrete

Based on 28-day compressive strength of 6- by 12- in. cylinders.

Proportions are expressed by volume as follows: Portland Cement: Fine Aggregate: Coarse Aggregate.

Thus 1:2.6:4.6 indicates 1 part by volume of portland cement, 2.6 parts by volume of fine aggregate and 4.6 parts by volume of coarse aggregate.

Size of coarse aggregate	Slump, in.	Proportions using fine aggregate of different sizes				
		0-No. 30	0-No. 16	0-No. 8	0-No. 4	0-⅜ in.
None..	½ to 1	1:1.5	1:1.7	1:2.0	1:2.3	1:2.7
	3 to 4	1:1.2	1:1.4	1:1.7	1:1.9	1:2.3
	6 to 7	**1:0.9**	**1:1.0**	**1:1.2**	**1:1.4**	**1:1.6**
	8 to 10	1:0.5	1:0.6	1:0.7	1:0.8	1:0.9
No. 4 to ¾ in.	½ to 1	1:1.3:2.7	1:1.5:2.6	1:1.7:2.5	1:1.9:2.4	1:2.3:2.1
	3 to 4	1:1.0:2.3	1:1.2:2.2	1:1.4:2.2	1:1.6:2.0	1:1.9:1.8
	6 to 7	**1:0.7:1.7**	**1:0.8:1.7**	**1:0.9:1.7**	**1:1.1:1.6**	**1:1.3:1.4**
	8 to 10	1:0.3:1.0	1:0.4:1.0	1:0.5:1.0	1:0.5:1.0	1:0.6:0.9
No. 4 to 1 in.	½ to 1	1:1.2:3.1	1:1.3:3.1	1:1.5:3.0	1:1.8:2.9	1:2.1:2.7
	3 to 4	1:0.9:2.7	1:1.1:2.6	1:1.2:2.6	1:1.4:2.5	1:1.7:2.3
	6 to 7	**1:0.6:2.0**	**1:0.7:2.0**	**1:0.8:2.0**	**1:0.9:1.9**	**1:1.1:1.8**
	8 to 10	1:0.3:1.2	1:0.3:1.2	1:0.4:1.2	1:0.5:1.2	1:0.6:1.2
No. 4 to 1½ in.	½ to 1	1:1.1:3.6	1:1.2:3.5	1:1.5:3.5	1:1.7:3.4	1:2.0:3.2
	3 to 4	1:0.9:3.0	1:1.0:2.9	1:1.2:2.9	1:1.4:2.9	1:1.6:2.7
	6 to 7	**1:0.6:2.2**	**1:0.7:2.2**	**1:0.8:2.2**	**1:0.9:2.2**	**1:1.1:2.1**
	8 to 10	1:0.3:1.4	1:0.3:1.3	1:0.4:1.4	1:0.5:1.4	1:0.5:1.3
No. 4 to 2 in.	½ to 1	1:1.0:4.1	1:1.1:4.1	1:1.2:4.1	1:1.4:4.1	1:1.6:4.0
	3 to 4	1:0.8:3.4	1:0.9:3.4	1:1.0:3.5	1:1.1:3.4	1:1.3:3.4
	6 to 7	**1:0.5:2.6**	**1:0.6:2.6**	**1:0.6:2.7**	**1:0.7:2.6**	**1:0.9:2.6**
	8 to 10	1:0.2:1.6	1:0.3:1.6	1:0.3:1.7	1:0.4:1.7	1:0.4:1.7
⅜ to 1 in.	½ to 1	1:1.4:3.1	1:1.5:3.0	1:1.8:2.9	1:2.1:2.8	1:2.4:2.6
	3 to 4	1:1.1:2.6	1:1.3:2.6	1:1.5:2.5	1:1.7:2.4	1:2.0:2.2
	6 to 7	**1:0.8:2.0**	**1:0.8:2.0**	**1:1.0:1.9**	**1:1.1:1.9**	**1:1.3:1.8**
	8 to 10	1:0.4:1.2	1:0.4:1.2	1:0.5:1.2	1:0.6:1.2	1:0.7:1.1
⅜ to 1½ in.	½ to 1	1:1.4:3.5	1:1.5:3.4	1:1.7:3.4	1:2.0:3.3	1:2.3:3.1
	3 to 4	1:1.1:3.0	1:1.2:2.9	1:1.4:2.9	1:1.6:2.8	1:1.9:2.6
	6 to 7	**1:0.8:2.2**	**1:0.8:2.2**	**1:1.0:2.2**	**1:1.1:2.1**	**1:1.3:2.0**
	8 to 10	1:0.4:1.4	1:0.4:1.4	1:0.5:1.4	1:0.6:1.3	1:0.7:1.3
⅜ to 2 in.	½ to 1	1:1.3:4.0	1:1.4:4.0	1:1.6:4.0	1:1.9:3.9	1:2.1:3.8
	3 to 4	1:1.0:3.4	1:1.2:3.4	1:1.3:3.3	1:1.5:3.3	1:1.7:3.2
	6 to 7	**1:0.7:2.6**	**1:0.8:2.5**	**1:0.9:2.6**	**1:1.0:2.6**	**1:1.1:2.5**
	8 to 10	1:0.4:1.6	1:0.4:1.6	1:0.5:1.6	1:0.5:1.6	1:0.6:1.6
¾ to 1½ in.	½ to 1	1:1.6:3.2	1:1.8:3.2	1:2.1:3.2	1:2.4:3.1	1:2.7:2.9
	3 to 4	1:1.3:2.7	1:1.5:2.7	1:1.7:2.7	1:2.0:2.6	1:2.3:2.5
	6 to 7	**1:0.9:2.0**	**1:1.0:2.1**	**1:1.2:2.0**	**1:1.4:2.0**	**1:1.5:1.8**
	8 to 10	1:0.5:1.2	1:0.5:1.3	1:0.6:1.3	1:0.7:1.3	1:0.8:1.2
¾ to 2 in.	½ to 1	1:1.6:3.7	1:1.8:3.7	1:2.0:3.7	1:2.4:3.6	1:2.6:3.5
	3 to 4	1:1.3:3.1	1:1.5:3.1	1:1.6:3.1	1:1.9:3.1	1:2.2:3.0
	6 to 7	**1:0.9:2.4**	**1:1.1:2.4**	**1:1.1:2.4**	**1:1.3:2.4**	**1:1.5:2.3**
	8 to 10	1:0.5:1.5	1:0.5:1.5	1:0.6:1.5	1:0.7:1.5	1:0.8:1.5
¾ to 3 in.	½ to 1	1:1.6:4.2	1:1.8:4.2	1:2.0:4.2	1:2.3:4.1	1:2.6:4.0
	3 to 4	1:1.3:3.5	1:1.5:3.6	1:1.6:3.6	1:1.9:3.6	1:2.1:3.5
	6 to 7	**1:0.9:2.6**	**1:1.0:2.6**	**1:1.1:2.6**	**1:1.3:2.6**	**1:1.4:2.6**
	8 to 10	1:0.5:1.6	1:0.5:1.6	1:0.6:1.7	1:0.7:1.7	1:0.8:1.7

Quantities of Materials for 1 Cu. Yd. of 3,000 Lb. per Square Inch Concrete

The volume of cement is expressed in barrels and of aggregates in cubic yards.
F = fine aggregate; C = coarse aggregate.
Quantities are net, no allowance being made for waste; for average conditions, the following additions are suggested: Cement, 2 per cent; fine aggregate, 10 per cent; coarse aggregate, 5 per cent.

Size of coarse aggregate	Slump, in.	Quantities of materials using fine aggregate of different sizes															
		0-No. 30			0-No. 16			0-No. 8			0-No. 4			0-3/8 in.			
		Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	
None	½ to 1	3.08	.68		2.96	.74		2.65	.78		2.34	.80		2.14	.86		
	3 to 4	3.61	.64		3.31	.69		2.93	.74		2.66	.75		2.37	.81		
	6 to 7	**3.99**	**.53**		**3.79**	**.56**		**3.57**	**.63**		**3.18**	**.66**		**2.93**	**.69**		
	8 to 10	4.77	.35		4.63	.41		4.34	.45		3.93	.47		3.79	.50		
No. 4 to ¾ in.	½ to 1	1.75	.34	.70	1.73	.38	.66	1.69	.42	.63	1.63	.46	.58	1.59	.54	.49	
	3 to 4	2.00	.30	.68	1.97	.35	.64	1.93	.40	.63	1.86	.44	.55	1.86	.52	.49	
	6 to 7	**2.48**	**.26**	**.62**	**2.46**	**.29**	**.62**	**2.38**	**.32**	**.60**	**2.37**	**.39**	**.56**	**2.35**	**.45**	**.49**	
	8 to 10	3.46	.15	.51	3.44	.20	.51	3.38	.25	.50	3.34	.25	.49	3.31	.29	.44	
No. 4 to 1 in.	½ to 1	1.68	.30	.77	1.65	.32	.76	1.60	.36	.71	1.55	.41	.66	1.53	.47	.61	
	3 to 4	1.88	.25	.75	1.86	.30	.72	1.83	.32	.70	1.78	.37	.66	1.76	.44	.60	
	6 to 7	**2.39**	**.21**	**.71**	**2.38**	**.25**	**.70**	**2.32**	**.27**	**.69**	**2.27**	**.30**	**.64**	**2.26**	**.37**	**.60**	
	8 to 10	3.32	.15	.59	3.30	.15	.59	3.25	.19	.58	3.21	.24	.57	3.18	.28	.56	
No. 4 to 1½ in.	½ to 1	1.58	.23	.84	1.55	.28	.80	1.50	.33	.78	1.46	.37	.73	1.46	.43	.69	
	3 to 4	1.80	.24	.80	1.78	.26	.76	1.73	.31	.74	1.68	.35	.72	1.67	.40	.67	
	6 to 7	**2.30**	**.20**	**.75**	**2.27**	**.24**	**.74**	**2.21**	**.26**	**.72**	**2.15**	**.29**	**.70**	**2.12**	**.35**	**.66**	
	8 to 10	3.19	.14	.66	3.17	.14	.61	3.09	.18	.64	3.04	.22	.63	3.02	.22	.58	
No. 4 to 2 in.	½ to 1	1.50	.22	.91	1.49	.24	.90	1.43	.25	.87	1.38	.29	.84	1.38	.33	.82	
	3 to 4	1.73	.20	.87	1.71	.23	.86	1.65	.24	.85	1.60	.26	.81	1.60	.31	.80	
	6 to 7	**2.18**	**.16**	**.84**	**2.14**	**.18**	**.82**	**2.06**	**.18**	**.82**	**2.01**	**.21**	**.77**	**2.01**	**.27**	**.77**	
	8 to 10	3.12	.09	.74	3.09	.14	.73	3.04	.14	.76	2.94	.17	.74	2.94	.17	.74	
⅜ to 1 in.	½ to 1	1.69	.35	.77	1.65	.37	.73	1.60	.43	.69	1.54	.48	.64	1.51	.54	.58	
	3 to 4	1.91	.31	.73	1.88	.36	.72	1.82	.40	.67	1.78	.45	.63	1.73	.51	.56	
	6 to 7	**2.40**	**.28**	**.71**	**2.36**	**.28**	**.70**	**2.31**	**.34**	**.65**	**2.26**	**.37**	**.64**	**2.19**	**.42**	**.58**	
	8 to 10	3.23	.19	.57	3.21	.19	.57	3.15	.23	.56	3.00	.27	.53	2.93	.30	.48	
⅜ to 1½ in.	½ to 1	1.57	.32	.81	1.55	.34	.78	1.50	.38	.75	1.45	.43	.71	1.43	.49	.66	
	3 to 4	1.81	.30	.81	1.78	.32	.76	1.73	.36	.74	1.68	.40	.70	1.63	.46	.63	
	6 to 7	**2.30**	**.20**	**.75**	**2.26**	**.27**	**.74**	**2.20**	**.33**	**.72**	**2.15**	**.35**	**.67**	**2.08**	**.35**	**.62**	
	8 to 10	2.97	.18	.61	2.94	.17	.61	2.88	.21	.60	2.87	.26	.60	2.78	.30	.55	
⅜ to 2 in.	½ to 1	1.49	.29	.88	1.48	.32	.88	1.42	.34	.84	1.36	.38	.77	1.34	.42	.75	
	3 to 4	1.73	.26	.87	1.70	.30	.86	1.63	.31	.80	1.58	.35	.77	1.55	.39	.73	
	6 to 7	**2.18**	**.23**	**.84**	**2.12**	**.25**	**.79**	**2.05**	**.27**	**.79**	**2.01**	**.30**	**.77**	**1.93**	**.31**	**.72**	
	8 to 10	2.98	.18	.71	2.99	.18	.71	2.90	.21	.69	2.93	.22	.69	2.84	.25	.67	
¾ to 1½ in.	½ to 1	1.55	.37	.73	1.52	.40	.72	1.48	.46	.70	1.41	.50	.65	1.38	.55	.59	
	3 to 4	1.79	.34	.71	1.75	.39	.70	1.71	.43	.68	1.63	.48	.63	1.59	.54	.59	
	6 to 7	**2.29**	**.30**	**.68**	**2.24**	**.33**	**.70**	**2.17**	**.39**	**.54**	**2.08**	**.43**	**.62**	**2.03**	**.45**	**.54**	
	8 to 10	3.03	.22	.54	3.01	.22	.58	2.93	.26	.56	2.90	.30	.56	2.88	.34	.51	
¾ to 2 in.	½ to 1	1.47	.35	.80	1.44	.38	.79	1.40	.41	.77	1.34	.48	.71	1.29	.50	.67	
	3 to 4	1.70	.33	.78	1.66	.37	.76	1.62	.38	.74	1.53	.43	.70	1.50	.49	.67	
	6 to 7	**2.16**	**.29**	**.77**	**2.08**	**.34**	**.74**	**2.04**	**.33**	**.73**	**1.92**	**.37**	**.68**	**1.90**	**.42**	**.65**	
	8 to 10	2.97	.22	.66	2.97	.22	.66	2.81	.25	.62	2.74	.28	.42	2.74	.23	.42	
¾ to 3 in.	½ to 1	1.39	.33	.86	1.35	.36	.84	1.30	.38	.81	1.25	.42	.76	1.21	.46	.71	
	3 to 4	1.60	.31	.83	1.55	.34	.83	1.52	.36	.81	1.46	.41	.78	1.42	.44	.73	
	6 to 7	**2.03**	**.27**	**.78**	**1.98**	**.29**	**.76**	**1.94**	**.32**	**.75**	**1.87**	**.36**	**.72**	**1.83**	**.38**	**.70**	
	8 to 10	2.87	.21	.68	2.85	.21	.67	2.75	.24	.69	2.69	.28	.68	2.64	.31	.66	

Proportions for 3,500 Lb. per Square Inch Concrete

Based on 28-day compressive strength of 6- by 12- in. cylinders.
Proportions are expressed by volume as follows: Portland Cement : Fine Aggregate : Coarse Aggregate.
Thus 1:2.6:4.6 indicates 1 part by volume of portland cement, 2.6 parts by volume of fine aggregate and 4.6 parts by volume of coarse aggregate.

Size of coarse aggregate	Slump, in	Proportions using fine aggregate of different sizes				
		0-No. 30	0-No. 16	0-No. 8	0-No. 4	0-⅜ in.
None	½ to 1	1:1.2	1:1.4	1:1.6	1:1.9	1:2.2
	3 to 4	1:1.0	1:1.1	1:1.3	1:1.5	1:1.8
	6 to 7	**1:0.6**	**1:0.8**	**1:0.9**	**1:1.0**	**1:1.2**
	8 to 10	1:0.3	1:0.4	1:0.4	1:0.5	1:0.6
No. 4 to ¾ in.	½ to 1	1:1.0:2.2	1:1.1:2.2	1:1.3:2.1	1:1.5:2.0	1:1.8:1.8
	3 to 4	1:0.8:1.9	1:0.9:1.9	1:1.0:1.8	1:1.2:1.7	1:1.4:1.5
	6 to 7	**1:0.5:1.3**	**1:0.6:1.4**	**1:0.6:1.3**	**1:0.8:1.3**	**1:0.9:1.2**
	8 to 10	1:0.2:0.7	1:0.2:0.7	1:0.3:0.7	1:0.3:0.7	1:0.4:0.6
No. 4 to 1 in.	½ to 1	1:0.9:2.6	1:1.0:2.6	1:1.2:2.5	1:1.4:2.4	1:1.6:2.3
	3 to 4	1:0.7:2.2	1:0.8:2.2	1:0.9:2.2	1:1.1:2.1	1:1.3:2.0
	6 to 7	**1:0 4:1.5**	**1:0.5:1.5**	**1:0.6:1.5**	**1:0.6:1.5**	**1:0.8:1.4**
	8 to 10	1:0.2:0.8	1:0.2:0.8	1:0.2:0.8	1:0.3:0.8	1:0.3:0.8
No. 4 to 1½ in.	½ to 1	1:0.9:2.9	1:1.0:2.9	1:1.1:2.9	1:1.3:2.8	1:1.5:2.7
	3 to 4	1:0.7:2.5	1:0.8:2.4	1:0.9:2.4	1:1.0:2.4	1:1.2:2.3
	6 to 7	**1:0.4:1.8**	**1:0.5:1.7**	**1:0.5:1.8**	**1:0.6:1.7**	**1:0.7:1.7**
	8 to 10	1:0.2:0.9	1:0.2:0.9	1:0.2:0.9	1:0.2:0.9	1:0.3:0.9
No. 4 to 2 in.	½ to 1	1:0.7:3.3	1:0.8:3.3	1:0.9:3.4	1:1.0:3.3	1:1.2:3.3
	3 to 4	1:0.6:2.8	1:0.6:2.8	1:0.7:2.8	1:0.8:2.8	1:1.0:2.8
	6 to 7	**1:0.3:2.0**	**1:0.4:2.0**	**1:0.4:2.0**	**1:0.5:2.0**	**1:0.6:2.0**
	8 to 10	1:0.1:1.0	1:0.1:1.0	1:0.2:1.0	1:0.2:1.0	1:0.2:1.0
⅜ to 1 in.	½ to 1	1:1.1:2.5	1:1.2:2.5	1:1.4:2.5	1:1.6:2.3	1:1.8:2.2
	3 to 4	1:0.8:2.1	1:0.9:2.1	1:1.1:2.1	1:1.3:2.0	1:1.5:1.9
	6 to 7	**1:0.5:1.5**	**1:0.6:1.5**	**1:0.7:1.5**	**1:0.8:1.4**	**1:0.9:1.4**
	8 to 10	1:0.2:0.8	1:0.2:0.8	1:0.3:0.8	1:0.3:0.8	1:0.4:0.7
⅜ to 1½ in.	½ to 1	1:1.0:2.8	1:1.2:2.8	1:1.3:2.8	1:1.6:2.7	1:1.8:2.6
	3 to 4	1:0.8:2.4	1:0.9:2.4	1:1.1:2.4	1:1.2:2.3	1:1.5:2.3
	6 to 7	**1:0.5:1.7**	**1:0.6:1.7**	**1:0.7:1.7**	**1:0.8:1.7**	**1:0.9:1.6**
	8 to 10	1:0.2:0.8	1:0.2:0.8	1:0.3:0.8	1:0.3:0.8	1:0.4:0.8
⅜ to 2 in.	½ to 1	1:1.0:3.2	1:1.1:3.2	1:1.2:3.2	1:1.4:3.2	1:1.6:3.1
	3 to 4	1:0.8:2.7	1:0.8:2.7	1:1.0:2.7	1:1 1:2.7	1:1.3:2.7
	6 to 7	**1:0.5:1.9**	**1:0.5:1.9**	**1:0 6:2.0**	**1:0.7:2.0**	**1:0.8:1.9**
	8 to 10	1:0.2:0.9	1:0.2:1.0	1:0.2:1.0	1:0.3:1.0	1:0.3:1.0
¾ to 1½ in.	½ to 1	1:1 3:2.6	1:1.4:2.7	1:1.6:2.6	1:1.9:2.6	1:2.2:2.4
	3 to 4	1:1.0:2.2	1:1.2:2.3	1:1.3:2.2	1:1.5:2.2	1:1.8:2.1
	6 to 7	**1:0.7:1.6**	**1:0.7:1.6**	**1:0 9:1.6**	**1:1.0:1.6**	**1:1.2:1.6**
	8 to 10	1:0.3:0.8	1:0.3:0.8	1:0.4:0.8	1:0.4:0.8	1:0.5:0.8
¾ to 2 in.	½ to 1	1:1.2:3.0	1:1.4:3.1	1:1.6:3.1	1:1.8:3.1	1:2.1:3.0
	3 to 4	1:1.0:2 5	1:1.1:2.6	1:1.2:2.6	1:1.5:2.6	1:1.7:2.5
	6 to 7	**1:0 6:1 8**	**1:0.7:1 8**	**1:0.8:1.9**	**1:0.9:1.9**	**1:1.1:1.9**
	8 to 10	1:0.3:0.9	1:0.3:0.9	1:0.3:0.9	1:0.4:0.9	1:0.5:0.9
¾ to 3 in.	½ to 1	1:1.2:3.4	1:1.3:3.4	1:1.5:3.4	1:1.7:3.3	1:2.0:3.3
	3 to 4	1:1.0:2.8	1:1.1:2.8	1:1.2:2.8	1:1 4:2 8	1:1.6:2.8
	6 to 7	**1:0.6:2 0**	**1:0.7:2.0**	**1:0.8:2.0**	**1:0.9:2.0**	**1:1 0:2.0**
	8 to 10	1:0.3:1.0	1:0.3:1.0	1:0.3:1.0	1:0.4:1.0	1:0.4:1.0

Quantities of Materials for 1 Cu. Yd. of 3,500 Lb. per Square Inch Concrete

The volume of cement is expressed in barrels and of aggregates in cubic yards.
F = fine aggregate; C = coarse aggregate.
Quantities are net, no allowance being made for waste; for average conditions, the following additions are suggested: Cement, 2 per cent; fine aggregate, 10 per cent; coarse aggregate, 5 per cent.

Size of coarse aggregate	Slump, in.	Quantities of materials using fine aggregate of different sizes																					
		0-No. 30			0-No. 16			0-No. 8			0-No.4			0-⅜ in.									
		Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.							
None	½ to 1	3	.58	.64	3	.38	.70	3	.11	.74	2	.71	.76	2	.48	.81							
	3 to 4	3	.90	.58	3	.83	.62	3	.51	.68	3	.13	.70	2	.81	.75							
	6 to 7	**4**	**.82**	**.43**	**4**	**.34**	**.52**	**4**	**.12**	**.55**	**3**	**.79**	**.56**	**3**	**.46**	**.61**							
	8 to 10				5	.00	.30	4	.95	.29	4	.48	.33	4	.37	.30							
No. 4 to ¾ in.	½ to 1	2	.08	.31	.68	2	.06	.34	.67	2	.01	.39	.63	1	.91	.42	.57	1	.92	.51	.51		
	3 to 4	2	.38	.28	.67	2	.36	.31	.66	2	.52	.37	.67	2	.25	.40	.57	2	.22	.46	.49		
	6 to 7	**3**	**.08**	**.23**	**.59**	**3**	**.02**	**.27**	**.63**	**2**	**.96**	**.26**	**.57**	**2**	**.88**	**.34**	**.56**	**2**	**.83**	**.38**	**.50**		
	8 to 10	4	.02	.12	.42	3	.96	.12	.41	3	.89	.17	.40	3	.83	.17	.40	3	.79	.22	.34		
No. 4 to 1 in.	½ to 1	1	.95	.26	.75	1	.93	.29	.74	1	.90	.34	.70	1	.84	.38	.65	1	.84	.43	.63		
	3 to 4	2	.27	.24	.74	2	.25	.27	.73	2	.18	.29	.71	2	.15	.35	.67	2	.10	.40	.62		
	6 to 7	**2**	**.93**	**.17**	**.65**	**2**	**.89**	**.21**	**.64**	**2**	**.79**	**.25**	**.62**	**2**	**.74**	**.24**	**.61**	**2**	**.67**	**.32**	**.55**		
	8 to 10	3	.88	.11	.46	3	.82	.11	.45	3	.79	.11	.45	3	.68	.16	.44	3	.67	.16	.43		
No. 4 to 1½ in.	½ to 1	1	.85	.25	.79	1	.85	.27	.79	1	.80	.29	.77	1	.70	.33	.70	1	.73	.38	.69		
	3 to 4	2	.14	.22	.79	2	.11	.25	.75	2	.05	.27	.73	1	.97	.29	.70	1	.98	.35	.67		
	6 to 7	**2**	**.76**	**.22**	**.74**	**2**	**.70**	**.20**	**.68**	**2**	**.59**	**.19**	**.69**	**2**	**.58**	**.23**	**.65**	**2**	**.58**	**.27**	**.65**		
	8 to 10	3	.79	.11	.50	3	.69	.11	.49	3	.67	.11	.49	3	.72	.11	.50	3	.80	.17	.51		
No. 4 to 2 in.	½ to 1	1	.79	.19	.87	1	.77	.21	.86	1	.71	.23	.86	1	.68	.25	.87	1	.65	.29	.81		
	3 to 4	2	.04	.18	.84	2	.00	.18	.83	1	.95	.20	.81	1	.92	.23	.80	1	.91	.28	.79		
	6 to 7	**2**	**.62**	**.12**	**.78**	**2**	**.50**	**.15**	**.77**	**2**	**.52**	**.15**	**.75**	**2**	**.50**	**.19**	**.74**	**2**	**.50**	**.22**	**.74**		
	8 to 10	3	.81	.06	.56	3	.75	.06	.56	3	.72	.11	.55	3	.68	.11	.54	3	.76	.11	.56		
⅜ to 1 in.	½ to 1	2	.02	.33	.75	1	.94	.34	.72	1	.88	.39	.69	1	.85	.44	.63	1	.79	.48	.58		
	3 to 4	2	.28	.27	.71	2	.24	.30	.70	2	.18	.35	.68	2	.14	.41	.63	2	.05	.45	.58		
	6 to 7	**2**	**.86**	**.21**	**.64**	**2**	**.84**	**.25**	**.63**	**2**	**.76**	**.29**	**.61**	**2**	**.74**	**.32**	**.57**	**2**	**.66**	**.35**	**.55**		
	8 to 10	3	.88	.11	.46	3	.82	.11	.45	3	.79	.17	.45	3	.68	.16	.44	3	.67	.22	.38		
⅜ to 1½ in.	½ to 1	1	.88	.28	.78	1	.85	.33	.77	1	.79	.34	.74	1	.74	.41	.70	1	.69	.45	.65		
	3 to 4	2	.16	.26	.77	2	.10	.28	.75	2	.04	.33	.73	1	.98	.35	.67	1	.93	.43	.66		
	6 to 7	**2**	**.72**	**.20**	**.68**	**2**	**.66**	**.24**	**.67**	**2**	**.59**	**.27**	**.65**	**2**	**.56**	**.30**	**.64**	**2**	**.52**	**.34**	**.60**		
	8 to 10	3	.79	.11	.45	3	.69	.11	.44	3	.67	.16	.43	3	.40	.15	.40	3	.31	.20	.39		
⅜ to 2 in.	½ to 1	1	.78	.26	.84	1	.75	.28	.83	1	.69	.30	.80	1	.63	.36	.77	1	.59	.38	.73		
	3 to 4	2	.03	.24	.81	1	.98	.23	.79	1	.93	.29	.77	1	.91	.31	.76	1	.84	.35	.73		
	6 to 7	**2**	**.58**	**.19**	**.73**	**2**	**.54**	**.19**	**.71**	**2**	**.49**	**.22**	**.74**	**2**	**.47**	**.25**	**.73**	**2**	**.40**	**.28**	**.68**		
	8 to 10	3	.80	.11	.51	3	.73	.11	.55	3	.64	.11	.54	3	.68	.16	.54	3	.56	.16	.53		
¾ to 1½ in.	½ to 1	1	.84	.35	.71	1	.82	.38	.73	1	.77	.42	.68	1	.68	.47	.65	1	.65	.54	.59		
	3 to 4	2	.13	.32	.69	2	.09	.37	.71	2	.02	.39	.66	1	.85	.41	.60	1	.89	.50	.59		
	6 to 7	**2**	**.68**	**.28**	**.64**	**2**	**.63**	**.27**	**.62**	**2**	**.56**	**.34**	**.61**	**2**	**.49**	**.37**	**.59**	**2**	**.45**	**.44**	**.58**		
	8 to 10	3	.79	.17	.45	3	.69	.16	.43	3	.67	.22	.43	3	.72	.22	.44	3	.66	.27	.43		
¾ to 2 in.	½ to 1	1	.76	.31	.78	1	.72	.36	.79	1	.67	.40	.77	1	.58	.42	.72	1	.55	.48	.69		
	3 to 4	2	.01	.30	.74	1	.95	.31	.75	1	.92	.34	.74	1	.84	.41	.71	1	.80	.45	.67		
	6 to 7	**2**	**.58**	**.23**	**.69**	**2**	**.54**	**.26**	**.68**	**2**	**.48**	**.29**	**.70**	**2**	**.40**	**.32**	**.68**	**2**	**.35**	**.38**	**.66**		
	8 to 10	3	.78	.17	.50	3	.73	.17	.50	3	.63	.16	.48	3	.59	.21	.48	3	.49	.26	.46		
¾ to 3 in.	½ to 1	1	.67	.30	.84	1	.61	.31	.81	1	.57	.35	.79	1	.51	.38	.74	1	.47	.43	.72		
	3 to 4	1	.91	.28	.79	1	.86	.30	.77	1	.93	.34	.80	1	.76	.36	.73	1	.71	.40	.71		
	6 to 7	**2**	**.48**	**.22**	**.74**	**2**	**.43**	**.25**	**.72**	**2**	**.37**	**.28**	**.70**	**2**	**.30**	**.31**	**.68**	**2**	**.25**	**.33**	**.67**		
	8 to 10	3	.64	.16	.54	3	.57	.16	.53	3	.52	.16	.52	3	.46	.20	.51	3	.38	.20	.50		

Proportions for 4,000 Lb. per Square Inch Concrete

Based on 28-day compressive strength of 6- by 12-in. cylinders.

Proportions are expressed by volume as follows: Portland Cement : Fine Aggregate : Coarse Aggregate.

Thus 1:2.6:4.6 indicates 1 part by volume of portland cement, 2.6 parts by volume of fine aggregate and 4.6 parts by volume of coarse aggregate.

Size of coarse aggregate	Slump, in.	Proportions using fine aggregate of different sizes				
		0-No. 30	0-No. 16	0-No. 8	0-No. 4	0-⅜ in.
None	½ to 1	1:0.9	1:1.1	1:1.2	1:1.5	1:1.7
	3 to 4	1:0.7	1:0.9	1:1.0	1:1.2	1:1.4
	6 to 7	**1:0.4**	**1:0.5**	**1:0.6**	**1:0.7**	**1:0.7**
	8 to 10	1:0.1	1:0.2	1:0.2	1:0.2	1:0.3
No. 4 to ¾ in.	½ to 1	1:0.8:1.8	1:0.9:1.8	1:1.0:1.8	1:1.2:1.7	1:1.4:1.5
	3 to 4	1:0.6:1.5	1:0.6:1.4	1:0.8:1.5	1:0.9:1.4	1:1.1:1.3
	6 to 7	**1:0.3:0.9**	**1:0.4:1.0**	**1:0.4:0.9**	**1:0.5:0.9**	**1:0.6:0.9**
	8 to 10	1:0.1:0.3	1:0.1:0.3	1:0.1:0.3	1:0.1:0.3	1:0.2:0.3
No. 4 to 1 in.	½ to 1	1:0.7:2.1	1:0.8:2.1	1:0.9:2.1	1:1.0:2.0	1:1.2:1.9
	3 to 4	1:0.5:1.7	1:0.6:1.6	1:0.7:1.7	1:0.8:1.7	1:0.9:1.6
	6 to 7	**1:0.3:1.1**	**1:0.3:1.1**	**1:0.4:1.1**	**1:0.4:1.1**	**1:0.5:1.1**
	8 to 10	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4
No. 4 to 1½ in.	½ to 1	1:0.6:2.4	1:0.7:2.4	1:0.8:2.4	1:1.0:2.3	1:1.1:2.2
	3 to 4	1:0.5:2.0	1:0.5:1.9	1:0.6:2.0	1:0.7:1.9	1:0.9:1.9
	6 to 7	**1:0.3:1.2**	**1:0.3:1.2**	**1:0.3:1 2**	**1:0.4:1 2**	**1:0.4:1 2**
	8 to 10	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4
No. 4 to 2 in.	½ to 1	1:0.5:2.7	1:0.6:2.7	1:0.7:2.7	1:0.8:2.7	1:0.9:2.8
	3 to 4	1:0.4:2.2	1:0.4:2.2	1:0.5:2.3	1:0.6:2.3	1:0.7:2.3
	6 to 7	**1:0.2:1.4**	**1:0.2:1.4**	**1:0.3:1.4**	**1:0.3:1.5**	**1:0 3:1.4**
	8 to 10	1:0.1:0.4	1:0.1:0.4	1:0.1:0.5	1:0.1:0.5	1:0.1:0.5
⅜ to 1 in.	½ to 1	1:0.8:2.1	1:0.9:2.0	1:1.0:2.0	1:1.2:1.9	1:1.4:1.8
	3 to 4	1:0.6:1.7	1:0.7:1.7	1:0.8:1.6	1:0.9:1.6	1:1.1:1.5
	6 to 7	**1:0.3:1.1**	**1:0.4:1.1**	**1:0.4:1.0**	**1:0.5:1.0**	**1:0.6:1.0**
	8 to 10	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4	1:0.2:0.4
⅜ to 1½ in.	½ to 1	1:0.8:2.3	1:0.9:2.3	1:1.0:2.3	1:1.2:2.3	1:1.4:2.2
	3 to 4	1:0.6:1.9	1:0.7:1.9	1:0.8:1.9	1:0.9:1.9	1:1.1:1.8
	6 to 7	**1:0.3:1.2**	**1:0.4:1.2**	**1:0.4:1.2**	**1:0.5:1.2**	**1:0.6:1.2**
	8 to 10	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4	1:0.1:0.4	1:0.2:0.4
⅜ to 2 in.	½ to 1	1:0.7:2.6	1:0.8:2.6	1:0.9:2.6	1:1.0:2.6	1:1.2:2.6
	3 to 4	1:0 6:2 1	1:0.6:2.2	1:0.7:2.2	1:0.8:2.2	1:1.0:2.2
	6 to 7	**1:0.3:1.4**	**1:0.3:1.4**	**1:0.4:1.4**	**1:0.4:1.4**	**1:0.5:1.4**
	8 to 10	1:0.1:0.4	1:0.1:0.4	1:0.1:0.5	1:0.1:0.4	1:0.1:0.5
¾ to 1½ in.	½ to 1	1:1.0:2.2	1:1.1:2.2	1:1.3:2.2	1:1.5:2.1	1:1.7:2.0
	3 to 4	1:0.8:1.8	1:0.9:1.8	1:1.0:1.8	1:1.2:1.8	1:1 3:1.7
	6 to 7	**1:0.4:1.1**	**1:0.5:1.1**	**1:0.6:1.2**	**1:0.7:1.1**	**1:0.8:1.1**
	8 to 10	1:0.1:0.4	1:0.1:0.4	1:0.2:0.4	1:0.2:0.4	1:0.2:0.4
¾ to 2 in.	½ to 1	1:0.9:2.5	1:1.0:2.5	1:1.2:2.5	1:1.4:2.5	1:1.6:2.5
	3 to 4	1:0.7:2.0	1:0.8:2.1	1:0.9:2.1	1:1.1:2.1	1:1.3:2 1
	6 to 7	**1:0.4:1.3**	**1:0.5:1.3**	**1:0.5:1.4**	**1:0.6:1.4**	**1:0.7:1.3**
	8 to 10	1:0.1:0.4	1:0.1:0.4	1:0.2:0.4	1:0.2:0.4	1:0.2:0.4
¾ to 3 in.	½ to 1	1:0.9:2.7	1:1.0:2.7	1:1.2:2.8	1:1.3:2.7	1:1.5:2.7
	3 to 4	1:0.7:2.2	1:0.8:2.3	1:0.9:2.3	1:1.0:2.3	1:1.2:2.2
	6 to 7	**1:0.4:1.4**	**1:0.4:1.4**	**1:0.5:1.5**	**1:0.6:1.5**	**1:0.7:1.5**
	8 to 10	1:0.1:0.5	1:0.1:0.5	1:0.1:0.5	1:0.2:0.5	1:0.2:0.5

Quantities of Materials for 1 Cu. Yd. of 4,000 Lb. per Square Inch Concrete

The volume of cement is expressed in barrels and of aggregates in cubic yards.
F = fine aggregate; C = coarse aggregate.
Quantities are net, no allowance being made for waste; for average conditions, the following additions are suggested: Cement, 2 per cent; fine aggregate, 10 per cent; coarse aggregate, 5 per cent.

Size of coarse aggregate	Slump, in.	Quantities of materials using fine aggregate of different sizes																				
		0-No. 30			0-No. 16			0-No. 8			0-No. 4			0-¾ in.								
		Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.	Cement	Aggregate F.	Aggregate C.						
None:	½ to 1	4.21	.56		3.91	.65		3.75	.79		3.19	.71		2.96	.75						
	3 to 4	4.64	.48		4.25	.57		4.03	.60		3.57	.64		3.27	.68						
	6 to 7	**5.05**	**.30**		**5.21**	**.39**		**4.89**	**.44**		**4.36**	**.45**		**4.41**	**.46**						
	8 to 10													4.78	.21						
No. 4 to ¾ in.	½ to 1	2.46	.29	.65	2.44	.32	.65	2.39	.35	.64	2.33	.41	.59	2.30	.48	.51						
	3 to 4	2.86	.25	.64	2.80	.25	.58	2.54	.32	.61	2.64	.35	.55	2.61	.42	.50						
	6 to 7	**3.68**	**.16**	**.49**	**3.67**	**.22**	**.54**	**3.62**	**.21**	**.48**	**3.56**	**.25**	**.48**	**3.54**	**.23**	**.34**						
	8 to 10	4.79	.06	.23	4.79	.07	.23	4.77	.08	.23	4.76	.10	.23	4.74	.11	.22						
No 4 to 1 in.	½ to 1	2.36	.24	.73	2.32	.27	.72	2.27	.30	.71	2.21	.33	.65	2.18	.39	.61						
	3 to 4	2.71	.20	.68	2.65	.24	.63	2.58	.27	.65	2.56	.30	.64	2.54	.34	.60						
	6 to 7	**3.59**	**.16**	**.58**	**3.58**	**.16**	**.58**	**3.51**	**.21**	**.57**	**3.46**	**.20**	**.56**	**3.48**	**.26**	**.57**						
	8 to 10	4.79	.05	.25	4.76	.05	.26	4.73	.07	.26	4.70	.08	.26	4.69	.09	.26						
No. 4 to 1½ in.	½ to 1	2.25	.20	.80	2.21	.23	.78	2.15	.25	.76	2.03	.30	.69	2.05	.33	.67						
	3 to 4	2.56	.19	.76	2.54	.19	.71	2.46	.22	.73	2.43	.25	.68	2.42	.32	.68						
	6 to 7	**3.48**	**.15**	**.62**	**3.47**	**.15**	**.62**	**3.39**	**.15**	**.60**	**3.34**	**.20**	**.59**	**3.34**	**.20**	**.59**						
	8 to 10	4.69	.04	.28	4.69	.05	.28	4.69	.06	.29	4.67	.07	.29	4.67	.08	.29						
No. 4 to 2 in.	½ to 1	2.14	.16	.86	2.10	.19	.84	2.03	.21	.81	2.00	.24	.80	1.91	.26	.79						
	3 to 4	2.47	.15	.80	2.45	.15	.80	2.37	.18	.81	2.33	.21	.79	2.31	.24	.78						
	6 to 7	**3.36**	**.10**	**.70**	**3.33**	**.10**	**.69**	**3.24**	**.14**	**.67**	**3.19**	**.14**	**.71**	**3.20**	**.14**	**.66**						
	8 to 10	4.69	.03	.31	4.68	.03	.30	4.67	.04	.32	4.61	.04	.33	4.54	.05	.33						
⅜ to 1 in.	½ to 1	2.36	.29	.73	2.32	.31	.69	2.26	.33	.67	2.22	.39	.62	2.13	.44	.57						
	3 to 4	2.65	.24	.67	2.62	.27	.66	2.58	.31	.61	2.54	.34	.60	2.48	.40	.55						
	6 to 7	**3.42**	**.15**	**.56**	**3.39**	**.20**	**.55**	**3.33**	**.20**	**.49**	**3.30**	**.24**	**.49**	**3.23**	**.29**	**.48**						
	8 to 10	4.79	.06	.26	4.76	.07	.25	4.73	.08	.26	4.70	.10	.25	4.69	.12	.24						
⅜ to 1½ in.	½ to 1	2.26	.27	.77	2.20	.29	.75	2.14	.32	.73	2.08	.37	.71	2.00	.41	.65						
	3 to 4	2.54	.23	.71	2.51	.26	.71	2.48	.29	.70	2.42	.32	.68	2.36	.38	.63						
	6 to 7	**3.24**	**.14**	**.58**	**3.17**	**.19**	**.56**	**3.16**	**.19**	**.56**	**3.10**	**.23**	**.55**	**3.13**	**.28**	**.56**						
	8 to 10	4.69	.06	.28	4.69	.07	.28	4.69	.08	.28	4.67	.09	.28	4.67	.11	.28						
⅜ to 2 in.	½ to 1	2.14	.22	.82	2.08	.25	.80	2.01	.27	.77	1.98	.29	.76	1.92	.34	.74						
	3 to 4	2.46	.22	.76	2.42	.21	.79	2.34	.24	.76	2.31	.27	.75	2.22	.33	.72						
	6 to 7	**3.14**	**.14**	**.65**	**3.07**	**.14**	**.64**	**3.02**	**.18**	**.63**	**3.02**	**.18**	**.63**	**2.98**	**.22**	**.62**						
	8 to 10	4.69	.05	.30	4.68	.06	.30	4.67	.07	.32	4.61	.08	.31	4.54	.08	.31						
¾ to 1½ in.	½ to 1	2.23	.33	.72	2.18	.35	.71	2.12	.41	.69	2.01	.45	.62	1.95	.49	.58						
	3 to 4	2.53	.30	.68	2.49	.33	.66	2.44	.36	.65	2.42	.43	.65	2.29	.44	.58						
	6 to 7	**3.18**	**.19**	**.52**	**3.12**	**.23**	**.51**	**3.03**	**.27**	**.54**	**2.97**	**.31**	**.48**	**2.98**	**.35**	**.49**						
	8 to 10	4.69	.08	.26	4.69	.10	.27	4.69	.11	.28	4.67	.12	.28	4.67	.15	.27						
¾ to 2 in.	½ to 1	2.11	.28	.78	2.05	.30	.76	1.99	.35	.74	1.91	.40	.71	1.88	.44	.69						
	3 to 4	2.44	.25	.72	2.39	.28	.74	2.34	.31	.73	2.24	.36	.70	2.18	.42	.68						
	6 to 7	**3.12**	**.18**	**.60**	**3.11**	**.23**	**.60**	**3.00**	**.22**	**.62**	**2.94**	**.26**	**.61**	**2.90**	**.30**	**.56**						
	8 to 10	4.69	.08	.29	4.68	.09	.30	4.67	.10	.30	4.61	.11	.30	4.54	.13	.30						
¾ to 3 in.	½ to 1	1.98	.25	.79	1.94	.29	.77	1.90	.34	.79	1.84	.35	.74	1.78	.40	.71						
	3 to 4	2.33	.24	.76	2.28	.27	.78	2.21	.30	.75	2.12	.31	.72	2.06	.37	.67						
	6 to 7	**3.00**	**.18**	**.62**	**2.97**	**.18**	**.62**	**2.96**	**.22**	**.66**	**2.90**	**.26**	**.64**	**2.77**	**.29**	**.62**						
	8 to 10	4.60	.08	.32	4.54	.08	.32	4.49	.09	.32	4.44	.10	.32	4.43	.12	.32						

CHAPTER VI

BRICKWORK

How to Estimate Brickwork.—The best method of estimating any kind of building material is to determine in the simplest way possible and with a reasonable degree of accuracy the actual amount of the material required to construct the work in hand. This applies equally well to brick as to other materials. It has been quite common in the past to estimate brickwork in a careless manner, making the number of bricks considerably larger than required. This method is no longer followed by the best contractors, but their estimators are endeavoring to figure the actual number of bricks required for the job. For brickwork this is most easily accomplished by recording the exact dimensions of the wall taking the corners but once, and figuring the pilasters, corbles, etc. their actual size. In taking off quantities, one should assume the wall to be solid and made up entirely of common brick. The outs are then deducted including all such items as doors, windows, stone belt courses, face brick, sunken panels, etc. The dimensions of a wall should always be given in the same order. The best arrangement is length by height by thickness. The first two dimensions should be given in feet and inches, the last in inches only, as follows: 2 end walls 87 ft. 6 in. by 18 ft. by 20 in.

Standard Size.—There has been a great deal of confusion in the past in estimating common bricks due to the variety of sizes that have been manufactured by different brickyards. This variation in size has made it almost impossible to make an accurate estimate of the number of bricks required for a given job. This has now been largely overcome, as in 1918 the National Brick Manufacturing Association adopted a standard size for common brick, namely 8 by $2\frac{1}{4}$ by $3\frac{3}{4}$ in. Since then, this size has been adopted by the American Brick Manufacturers Association, the American Society for Testing Material, the American Society of Civil Engineers and the American Institute of Architects. This size will therefore be the only size in common use in this country as soon as the brickyards have procured the necessary machinery for their manufacture.

Extending Quantities.—In making extensions it is customary to multiply together the figures representing the number of items by the length by the height by the number of brick per superficial foot of wall for the given thickness. This number depends upon the thickness of the mortar joints. The accompanying table gives the number of bricks per superficial foot of wall for joints from ⅛ to ¾ in. thick.

Thickness of Joints and Waste.—The thickness of joints is sometimes given in the specification but if not, common bricks are usually laid with joints from ¼ to ½ in. thick depending upon the kind of mortar. The number of bricks shown in the table does not provide for any waste. Under ordinary circumstances about 5 per cent should therefore be added to take care of waste.

Amount of Mortar Required.—The amount of mortar required for brickwork depends primarily upon the thickness of the joints and to a lesser degree on the thickness of the wall. The difference due to thickness of the wall is not great and can be overlooked. For example, the amount of mortar required per thousand brick for different thickness of wall using ½-in. joint is as follows: for 8-in. wall 15.1 cu. ft., for 12¼-in. wall 16.2 cu. ft., for 16½-in. wall 17.0 cu. ft., and for 20½-in. wall 16.4 cu. ft. It is thus evident that if one estimates the amount of mortar required for a 12¼-in. wall, the result will be approximately correct.

BRICKWORK

(Number of bricks per superficial foot per course and amount of mortar required to lay 1,000 bricks)

Joint, in.	Standard size face or common 8 by 2¼ by 3¾ in.			Roman 12 by 4 by 1½ in.			Norman 12 by 4 by 2⅜ in.		
	Number of brick	Mortar		Number of bricks	Mortar		Number of brick	Mortar	
		Cu. ft.	Cu. yd.		Cu. ft.	Cu. yd.		Cu. ft.	Cu. yd.
⅛	7.5	6.1	0.22	7.3	9.6	0.36	4.8	13.0	0.48
¼	7.0	9.3	0.35	6.7	14.2	0.52	4.5	17.8	0.66
⅜	6.6	12.7	0.47	6.2	18.8	0.70	4.2	22.7	0.84
½	6.2	16.2	0.60	5.8	23.4	0.87	4.0	27.6	1.02
⅝	5.8	19.7	0.73	5.4	28.2	1.04	3.8	32.7	1.21
¾	5.5	23.4	0.87	5.0	33.0	1.22	3.6	37.8	1.40

Extra Face Brick Required for Various Bonds.—The number of face bricks as given in the table is sufficient for straight running bond where either wall ties or clipped bricks are used to tie them back.

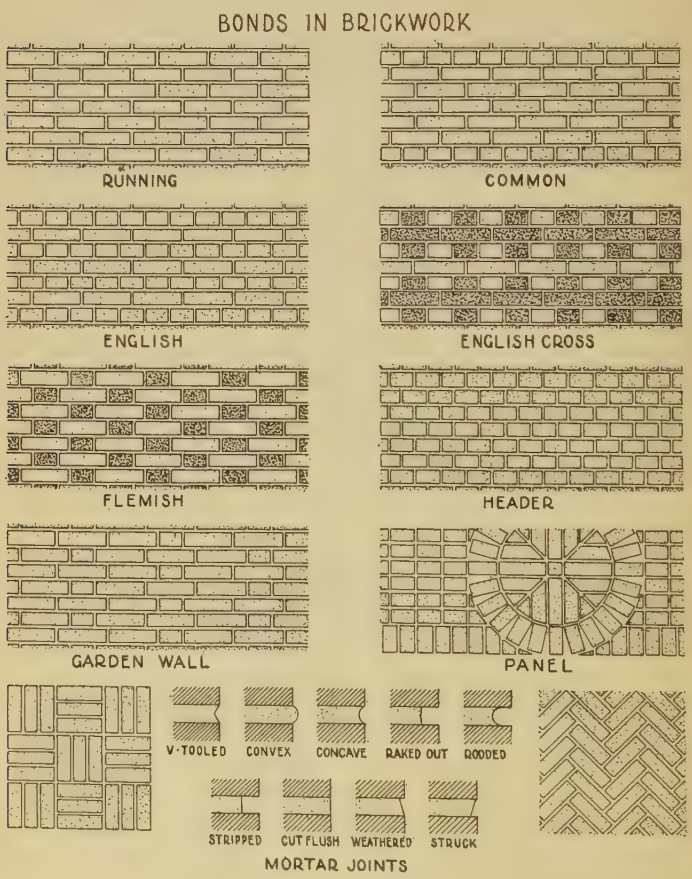


Fig. 1.

Additional face bricks, however, are required for the various other kinds of bonds in proportion to the number of through headers used. For other bonds the following percentages should be added to the number of face bricks as given in the table;

	Per Cent
Common, with full headers every fifth course	20 or $\frac{1}{5}$
Common, with full headers every sixth course	$16\frac{2}{3}$ or $\frac{1}{6}$
Common, with full headers every seventh course	$14\frac{1}{3}$ or $\frac{1}{7}$
English, or English Cross, full headers every sixth course	$16\frac{2}{3}$ or $\frac{1}{6}$
Flemish, full headers every sixth course	$5\frac{2}{3}$ or $\frac{1}{18}$
Double header, two headers and a stretcher every sixth course	$8\frac{1}{3}$ or $\frac{1}{12}$
Double header, two headers and a stretcher every fifth course	10 or $\frac{1}{10}$

Kind of Mortar.—Mortar for brickwork is usually specified as being either portland cement mortar, lime mortar or some combination of cement and lime. It is difficult for masons to lay brick in cement mortar without any lime as the mortar is short and crumbles and does not usually fill the joints. If 10 per cent of lime is added, the mortar works more easily permitting the masons to do more rapid and better work. The addition of 10 per cent lime does not weaken the mortar but according to most authorities is an actual improvement both in strength and in water-resisting qualities. The accompanying mortar tables give the amounts of lime, portland cement and sand necessary to make 1 cu. yd. of mortar under ordinary conditions. The first figure in the mix represents either lime, cement or any combination of the two and the second figure gives the proportion of sand. If the sand is fine, the table for sand with 35 per cent voids should be used, but if the sand is coarse, the table for sand with 40 per cent voids.

The amount of lime given in these tables is for hydrated lime on the assumption that 40 lb. of lime will make 1 cu. ft. of lime paste. If quicklime is used, about 30 lb. will be required per cubic foot of paste or about three-fourths as much as shown in the table. In case quicklime paste is used the number of cubic feet of paste required can be found by dividing the weight of lime given in the table by 40.

Labor to Make Lime Mortar.—An experienced mortar mixer will slake, sand and mix about 4 cu. yd. of lime mortar in an 8-hr. day.

Seasoning Lime Putty.—When lump lime is used, it should be slaked as described in the chapter on Plastering. After all slaking action has ceased, a part or all of the sand required should be added and the mortar stored for at least 24 hr. before using.

MORTAR

Using sand with 35 per cent voids

Material required for 1 cu. yd.

Mix		Lime, Per cent	100	90	80	70	60	50	40	30	20	10	0
		Cement, Per cent....	0	10	20	30	40	50	60	70	80	90	100
1:1....	Lime, lb.....		655	589	524	458	393	327	262	196	131	65	
	Cement, bbl.....		....	0.44	0.87	1.31	1.74	2.18	2.61	3.04	3.48	3.92	4.35
	Sand, cu. yd.....		0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
1:1½..	Lime, lb.....		547	492	437	383	328	273	219	164	109	55	
	Cement, bbl.....		....	0.36	0.73	1.09	1.45	1.82	2.18	2.54	2.91	3.27	3.63
	Sand, cu. yd.....		0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
1:2....	Lime, lb.....		470	423	376	329	282	235	188	141	94	47	
	Cement, bbl.....		....	0.31	0.62	0.94	1.25	1.56	1.87	2.19	2.50	2.81	3.12
	Sand, cu. yd.....		0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
1:2½..	Lime, lb.....		411	370	329	288	247	206	165	123	82	41	
	Cement, bbl.....		....	0.27	0.55	0.82	1.09	1.37	1.64	1.91	2.19	2.46	2.74
	Sand, cu. yd.....		0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
1:3....	Lime, lb.....		360	324	288	252	216	180	144	108	72	36	
	Cement, bbl.....		....	0.24	0.48	0.72	0.96	1.20	1.44	1.68	1.91	2.15	2.39
	Sand, cu. yd.....		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1:3½..	Lime, lb.....		309	278	247	216	185	154	123	93	62	31	
	Cement, bbl.....		....	0.20	0.41	0.61	0.82	1.03	1.23	1.44	1.64	1.85	2.05
	Sand, cu. yd.....		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1:4....	Lime, lb.....		270	243	216	189	162	135	108	81	54	27	
	Cement, bbl.....		....	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.52	1.79
	Sand, cu. yd.....		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Making Cement Mortar.—To make cement mortar, the cement and sand are mixed dry until uniform in color throughout. If lime is to be added, hydrated lime works best and should be put in at the same time as the cement. Cement mortar must be mixed in small batches as it should be used within 30 min. from the time when it is mixed. If the job is large enough to warrant it, the best way to mix cement mortar is by machine. If mixed by hand the time required is about the same as given for lime mortar. This labor, however, is usually performed by the mason's helpers and is included in the time required for laying the brick.

MORTAR

Using sand with 40 per cent voids

Material required for 1 cu. yd.

Mix		Lime, Per cent	100	90	80	70	60	50	40	30	20	10	0
		Cement, Per cent	0	10	20	30	40	50	60	70	80	90	100
1:1	Lime, lb.		675	608	540	473	405	338	270	203	135	68	
	Cement, bbl.		....	0.45	0.90	1.35	1.80	2.24	2.69	3.14	3.59	4.04	4.49
	Sand, cu. yd.		0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
1:1½	Lime, lb.		568	512	455	398	341	284	227	171	114	57	
	Cement, bbl.		....	0.38	0.76	1.13	1.51	1.89	2.27	2.65	3.02	3.40	3.78
	Sand, cu. yd.		0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
1:2	Lime, lb.		491	442	393	344	295	245	196	147	98	49	
	Cement, bbl.		....	0.33	0.65	0.98	1.31	1.63	1.96	2.28	2.61	2.94	3.26
	Sand, cu. yd.		0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
1:2½	Lime, lb.		432	389	346	302	259	216	173	130	86	43	
	Cement, bbl.		....	0.29	0.57	0.86	1.15	1.44	1.72	2.01	2.30	2.59	2.87
	Sand, cu. yd.		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1:3	Lime, lb.		360	324	288	252	216	180	144	108	72	36	
	Cement, bbl.		....	0.24	0.48	0.72	0.96	1.20	1.44	1.68	1.91	2.15	2.39
	Sand, cu. yd.		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1:3½	Lime, lb.		309	278	247	216	185	154	123	93	62	31	
	Cement, bbl.		....	0.20	0.41	0.61	0.82	1.03	1.23	1.44	1.64	1.85	2.05
	Sand, cu. yd.		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1:4	Lime, lb.		270	243	216	189	162	135	108	81	54	67	
	Cement, bbl.		....	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.79
	Sand, cu. yd.		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

The Amount of Labor Required for Laying Brickwork.—The amount of labor required to lay brickwork will vary with the different classes of work to be performed, with the kind of mortar used and with the thickness of joints. If a lime mortar is used, masons will lay from 10 to 20 per cent more brick than they will with all cement mortar, and on heavy masonry walls or foundation work they will lay considerably more than where the walls are above grade or more irregular. Some time of course is always lost in laying corners, pilasters, window and door jambs, etc. Hence it is impossible to specify accurately the amount of brick a man can lay per day in a wall under these conditions.

The accompanying table, however, is designed for average conditions and gives approximately the amount of mason labor required to lay a thousand bricks in the various kinds of wall specified. The time as indicated in the table is on the assumption that a good grade of mason labor is employed and well supervised, and that either lime mortar or cement mortar with not less than 10 per cent of lime added is used.

LABOR TO LAY 1,000 BRICKS

Kind of work	Kind of brick	No. of hours
Foundation walls not less than 16 in. thick	Common	5½
Warehouse and factory wall not less than 16 in. thick	Common	6¾
16-in. factory wall with pilasters, cornices, etc	Common	8¼
12-in. factory wall very plain	Common	8¼
8-in. factory wall very plain	Common	10¼
12-in. wall with pilasters, cornices, etc	Common	9¼
8-in. wall with pilasters, cornices, etc	Common	12
8- and 12-in. backing for stone and face brick	Common	7¾
Brick chimney from 100 to 150 ft. high	Common	16
Fire brick, breechings, lining of stacks, etc	Fire	20
8 by 2¼ by 3¾-in. face brick, all stretchers	Face	17½
8 by 2¼ by 3¾-in. face brick, Flemish bond	Face	21
12 by 4 by 1½-in. face brick, all stretchers	Roman	24
12 by 4 by 1½-in. face brick, Flemish bond	Roman	30
12 by 4 by 2⅜-in. face brick, all stretchers	Norman	30
12 by 4 by 2⅜-in. face brick, Flemish bond	Norman	36
Enameled or glazed brick, 8 by 2¼ by 3¾ in., all stretchers	Face	20
Enameled or glazed brick, 12 by 4 by 1½ in., all stretchers	Roman	40
Enameled or glazed brick 12 by 4 by 2⅜ in., all stretchers	Norman	48
Face or pressed brick in floors laid straight	Face	12
Face or pressed brick in floors laid herringbone	Face	30

Number of Masons' Helpers or Hod Carriers Required.—The number of hod carriers required will vary somewhat on different grades of work, more being required on heavy work than on light, especially for small irregular buildings with many openings. Many contractors employ an equal number of masons and hod carriers, but on heavy work it is frequently advisable to employ from 10 to 25 per cent more hod carriers than masons.

Cost of Labor to Lay Brick.—It is not necessary to estimate separate labor hours for brick masons and hod carriers as the cost of hod carriers can be taken care of in pricing the mason labor. A convenient method of doing this is as follows: Where an equal number of masons and hod carriers are used, the rate per hour paid hod carriers must be added to the rate paid masons and the number of hours given in the table multiplied by the combined rate. If more or fewer hod carriers than masons are used, a corresponding percentage should be added to or subtracted from the rate paid hod carriers before adding the masons rate. For example, if the masons are paid $1 per hour, hod carriers 60 cts. per hour and 10 per cent more hod carriers are used than masons, $1 would be added to 60 cts. plus 10 per cent of 60 cts. or 6 cts., giving a total of $1.66 per hour as the rate to be used. It is possible also to include the mason foremen if so desired. If, for instance, the foreman receives $15 a day and the payroll for masons and hod carriers combined is $150 a day, an additional 10 per cent should be added to the combined rate which would give $1.826 or say $1.83 per hour as the rate to be used.

Mortar Color.—Mortar color comes in two forms, in pulp or paste and in dry powder. Pulp colors are more expensive than dry colors and do not go as far per unit of weight. They are, however, a little easier to use as they are ready when received to incorporate into the mortar. Dry colors will work better and go farther if put in a barrel and wet two or three days before using. They should be stirred occasionally to remove the lumps.

For cement mortar, the Alpha Portland Cement Company recommends the quantities of colors indicated in the following table:

TABLE OF COLORS TO BE USED IN PORTLAND CEMENT

Color desired	Commercial names of colors for use in cement	Pounds of color required for each bag of cement to secure	
		Light shade	Medium shade
Grays, blue-black and black	Germantown lampblack	½	1
	Carbon black	½	1
	Black oxide of manganese	1	2
Blue shade	Ultramarine blue	5	10
Brownish-red to dull brick-red	Red oxide of iron	5	10
Bright red to vermilion	Mineral turkey red	5	10
Red sandstone to purplish-red	Indian red	5	10
Brown to reddish-brown	Metallic brown (oxide)	5	10
Buff, colonial, tint and yellow	Yellow ochre	5	10
Green shade	Chromium oxide	5	10

Some colors are much stronger than others. Black usually goes farther than red, brown, etc. In general, for lime mortar about 200 lb. of dry color are required per cubic yard of mortar and about 20 per cent more of pulp color. This is equivalent to saying that it requires about 100 lb. of color per thousand bricks when laid with ½-in. joints. Of course colored mortar is used only for face brick. Mortar color should never be put into lime mortar until the mortar is entirely cold as hot lime will bleach the color. The color should be mixed while making the mortar as the mixing will be better done and with little or no additional expense.

The present market price per pound, for dry mortar color bought in ton lots is as follows: red 2¾ cts., light brown 3 cts., dark brown 3¾ cts., buff 3½ cts. and black 4 cts. If bought in car-load lots the price is somewhat less, and in small quantities about 25 per cent more. The price for pulp color is about 25 per cent higher than for dry color.

Cleaning and Pointing Face Brick.—The cost of cleaning and pointing face brick will vary with the different kinds of brickwork. It is more difficult to clean rough texture bricks than those with a smooth surface. If the bricks are smooth and there is little or no repointing, a man should clean from 800 to 1,000 sq. ft. per day of 8

hr. For rough texture brick with more or less pointing to be done, the amount may easily fall to 500 or 600 sq. ft. per day. On some difficult work where bricks are badly smeared with cement mortar, a man must work hard to do 300 sq. ft. in a day. In addition to the labor it is necessary to include the cost of a swinging scaffold, scrub brushes, and muriatic acid. The amount of acid required varies, but a fair average is 1 gal. per 1,000 sq. ft. of wall. The acid is usually diluted with water using about 9 or 10 gal. of water to 1 gal. of acid. Muriatic acid weighs 10 lb. per gallon and is usually sold in 20-gal. carboys. The present market price is about $1 per 100 lb. Stiff fiber brushes are used for scrubbing the brick and the brushes wear out rapidly. The cost for brushes for any given job is about the same as the cost of the acid.

BRICK FIREPLACES

The following information regarding brick fireplaces is given in the Manual of Face Brick Construction by the American Face Brick Association and is reliable and accurate:

Location of the Fireplace.—The location of the fireplace in the room is of great importance to its enjoyment. As it is the most ornamental feature of the interior of the house, it should be given a prominent position, but it should not be in the line of travel through the room, near the entrance door, or where a cross-draft sweeps it. The far end of the room is one of the best locations; or better still, an ingle nook. If placed on the broad side of a room, it is pretty sure to project so far as to reduce the practicable width of the room and force the rug over the hearth. If placed on an outside wall, it is best not to have large flanking windows, as one does not like to sit facing too much light, especially when a strong sun is shining.

Proper proportions of the fireplace opening and flue are among the most essential features of fireplace construction. The larger the opening, the larger the fire may be and the more air required or taken from the room for proper combustion, provided the flue is large enough to give sufficient draft. In the average home, the actual inside area of flue should never be less than one-tenth of the area of the fireplace opening. Each fireplace should have its own individual flue carried full size to the top of the chimney without connections of any kind from other sources. A low, broad opening is preferred to a narrow, high one, and splayed sides are best in any case, because better draft and radiation are thus

secured. A low, broad opening will catch the smoke better and direct it up the chimney.

Construction and Dimensions for Fireplaces.—The following dimensions for fireplaces are considered good practice:

FIREPLACE OPENINGS

WIDTH	HEIGHT	DEPTH
2 ft. 8 in.	2 ft. 4 in.	17 to 21 in.
3 ft. 0 in.	2 ft. 4 to 6 in.	21 in.
4 ft. 0 in.	2 ft. 8 in.	21 to 25 in.

Arched openings may be higher than indicated in the above dimensions, as their average height may be taken as the top line of the opening.

The ideal form of a fireplace would be a cone with all sides tapering to the apex for the escape of smoke. Therefore, to approach this ideal in practice, the sides of the fireplace are splayed and the back curved forward as shown in Figs. 2 and 3. This forward curve of the back

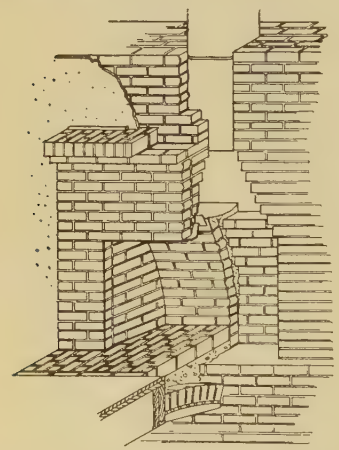


FIG. 2.—Part perspective of fireplace.

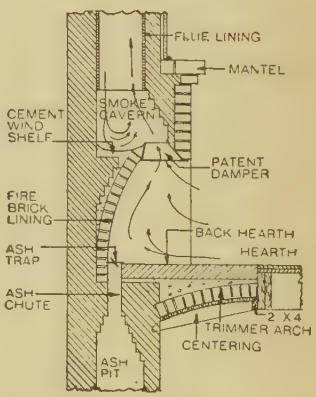


FIG. 3.—Cross-section of fireplace.

throws the smoke from the fire forward to a throat 4 in. wide, extending the full width of the opening at the front and top of the fireplace, and at the same time forms a shelf above for the deflection of down drafts in the chimney. The rear wall of the fireplace should never be straight, having the throat at the rear, as down drafts would be sure to blow smoke and dust into the room.

The Damper.—Always place a damper in the throat for regulation of the draft. The dampers should completely fill the throat. There are many dampers on the market that also serve the purpose of a lintel for the brickwork, giving a smooth surface for the exit of the smoke. These patent combinations of damper and throat give a good draft, prevent smoke, and deserve a more general use

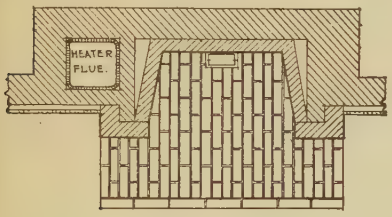


FIG. 4.—Hearth with brick on edge.

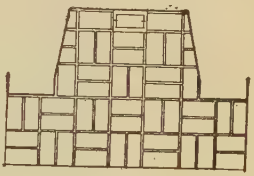


FIG. 5.—Hearth with brick flat.

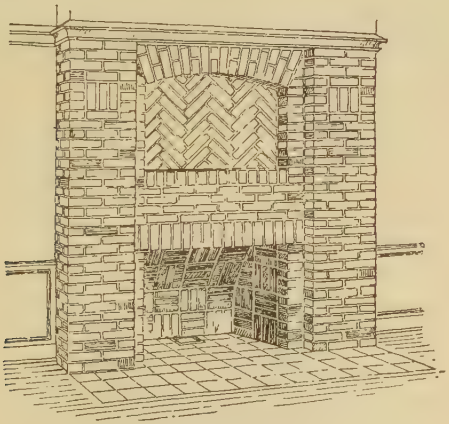


FIG. 6.—Fireplace design.

Especial care should be taken in laying up the brickwork above and around the damper. The joints should be well filled, and nowhere should there be less than an 8-in. thickness of brickwork unless protected by a flue lining.

The Flue.—Immediately above the damper, the brickwork should be corbeled in both ways to the size of the flue lining, which should always be started on a line with the middle of the fireplace and run vertically for one length. It then may be jogged over to the location desired on the

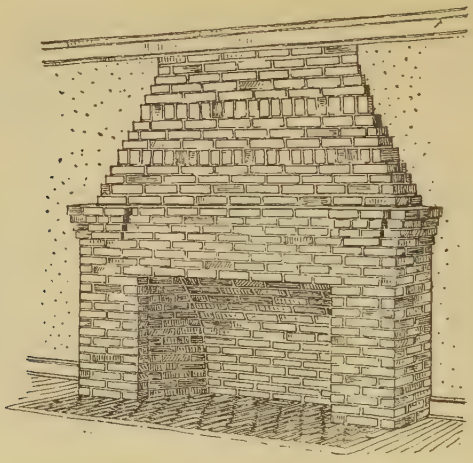


FIG. 7.—Fireplace design.

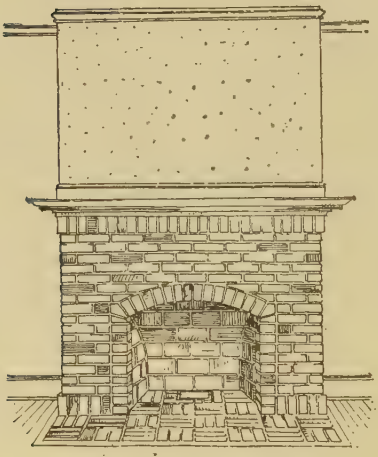


FIG. 8.—Fireplace design.

floor above. It should be started as low as possible as this is the hottest part of the chimney.

The back and sides of the fireplace, as well as the back portion of the hearth are usually built of firebrick. Certain kinds of facebrick are suitable for this purpose and have been used by architects with very artistic results.

The Hearth.—The hearth may be either of facebrick or tile. If of brick, the brick should be preferably smooth so as to facilitate cleaning. They may be laid either on edge or flat in a variety of patterns. Two examples of brick hearths are shown in Figs. 4 and 5, one with the brick set on edge and the other with the brick laid flat. Tiles may be of any size and laid in various patterns, and if suitable, may be used also in the back portion of small hearths. The mortar joints of the hearth should be thin and preferably of a fire clay mortar, though pure cement mortar will answer the purpose. Wherever possible, an opening and ash chute in the back hearth, with a pit and iron cleanout door in the basement, should be installed.

Always build the fireplace in the rough first, leaving the brick facing and hearth to be finished after the plasterer has completed his work. The accompanying designs, Figs. 6, 7 and 8, suggest various methods of treatment.

CHAPTER VII

STONE MASONRY

RUBBLE MASONRY

Rubble stone masonry is gradually being supplanted by concrete as the latter makes a stronger and, in most cases, a more economical wall. A rubble wall should be at least 20 in. thick, whereas concrete can be made any thickness required.

Footing courses should be built of stones the full width of the footing, if possible. If the wall is heavily loaded the footing course should be of concrete. Stone footings should be of strong hard stone, laid on their natural bed. This means that the stone should be laid in the same position it occupied when quarried. If laid with the strata vertical, in an exposed position, it will crack and spall. For stepped footings the thickness of each course is at least equal to its projection beyond the course above.

Quarried stone is preferable to field stone, as it is usually rectangular in shape and consequently easier to lay. Bondstones the full width of the wall should be spaced about 3 or 4 ft. apart and have their exposed faces hammer dressed. Corners should be well bonded with large stones. Walls should be laid up to a straight line and present a smooth face, the stones being dressed to form a good bed. A minimum amount of spalls should be used, not more than are required to fill the voids between the larger stones.

Estimating.—In estimating the stonework, it should be computed in cubic yards, taking only the actual volumes and deducting for openings. The mortar required will vary from 6 to 9 cu. ft. per cubic yard of masonry, depending on the size of the stones and the skill of the stone masons in fitting and setting. See "Mortar Tables," pages 142 and 143, for quantity of materials required.

Labor.—A stone mason and a laborer will lay, on walls averaging from 2 to 3 ft. thick, about ½ cu. yd. in 1 hr. or 4 cu. yd. in 8 hr.

Two cubic yards per day of 8 hr. must be figured for ornamental rubble or cobble ashlar work, backed by brick or tile, such as chimneys, when small stones from 4 to 8 in. are used. On larger

stones a mason will average 3 cu. yd. per 8 hr. This does not include the brick or tile work.

CUT STONE WORK

Indiana Limestone.—The following items are to be looked for in estimating limestone: cornices, pediments, copings, sills, steps, platform slabs, facings and coping of approach work, area walls, lintels, arches, architraves, imposts, key blocks, panels, balustrades, turrets, finials, piers, vault ribs, vaulted ceilings and all other work so specified on drawings, including plaster models and all ornamental and carved decoration occurring in connection with this work.

PRICE PER CUBIC FOOT FOR INDIANA LIMESTONE F.O.B. QUARRIES

Grades	Rough blocks	Scrabbled blocks	Sawed two sides	Sawed four sides
Select gray stock	$0.70	$0.80	$1.00	$1.35
Standard gray stock	0.60	0.70	0.90	1.25
Variegated stock	0.55	0.65	0.85	1.20
Select buff stock	0.80	0.90	1.10	1.45
Standard buff stock	0.70	0.80	1.00	1.35
Rustic buff	0.45	0.55	0.75	0.10

PRICE PER LINEAL FOOT FOR STANDARD GRAY STOCK F.O.B. QUARRIES

Planed and jointed	Size, in.	Price per foot
Common window sills without lugs or drip	7 by 5	$0.61
Common window sills without lugs or drip	8 by 5	0.68
Lug window sills with water bar and drip	7 by 5	0.69
Lug window sills with water bar and drip	8 by 5	0.76
Plain door sills for 12-in. wall	13 by 7	1.37
Plain lintels	4 by 9	0.60
Plain lintels	4 by 12½	0.82
Plain coping with drip both sides	12 by 4	0.87
Coping with wash and drip saddle back	16 by 6	1.53
Steps and platform	7 by 14	1.54

Freight.—The present carload rates from the Bedford, Indiana, district on stone either rough quarried, sawed or dressed are as follows:

	Cents per Hundredweight		Pounds
Boston, Mass	42	Minimum car	36,000
New York, N. Y	40	Minimum car	36,000
Chicago, Ill	17½	Minimum car	36,000
St. Louis, Mo	17½	Minimum car	36,000
Salt Lake City, Utah	74		30,000
Denver, Colo	48½	Minimum car	40,000
San Francisco, Cal	79½		60,000

The present less than carload rates are as follows:

	Rough quarried, sawed 2 or 4 sides, cents per hundredweight	Sawed 6 sides, dressed, cents per hundredweight
Boston, Mass	70	79½
New York, N. Y	66	75½
Chicago, Ill	39	41½
St. Louis, Mo	37½	40
Salt Lake City	252 (Utah)	254½
Denver, Colo	159½	162
San Francisco	322½ (Cal.)	322½

Practically all stone from the Bedford District is sold by the cubic foot and at a price which includes the freight. This price is obtained by adding to the quarry price the freight charges estimated on the following weights for stone.

Rough stone 200 lb. per cubic foot
Sawed stone 170 lb. per cubic foot
Dressed stone 150 lb. per cubic foot

Most of the stone from this district is shipped in carload lots. As a rule small orders are purchased from the local dealers.

Hauling and Storage.—Limestone can be hauled either by wagon or truck but should be handled by thoroughly competent workmen

who will guard against soiling, mutilating or snipping it in transit. Because of the extra care required, the cost of hauling limestone is about 50 per cent more than the cost of hauling common brick and other such materials. The stone should be stored at the building site and should be entirely free from the ground and protected. If compelled to remain long at the building before installation, it should be covered by tarpaulin or stout non-staining paper.

Labor Required to Handle and Set Cut Stone.—The cost of labor for handling and setting cut stone will depend upon the size of the job, the size and kind of the stone and the method employed for setting, whether by hand, by hand-operated derrick, or by power derrick.

Setting Stone by Hand.—On small jobs where the cut stone work consists principally of door and window sills, lintels, copings, steps, etc., it is frequently possible to set the stone without a special derrick. The gang usually consists of a mason, a mason's helper and a laborer. They should set from 6 to 8 cu. ft. per hour.

Setting Cut Stone Using Hand Derrick.—On jobs using cut stone such as coarsed ashlar, sills, lintels, cornices, etc., of light weight, where the work is handled by breast derrick, the gang usually consists of a mason, a helper and about 4 common laborers. Such a gang should be able to set 12 to 15 cu. ft. of stone per hour. On good sized jobs under favorable conditions they may even set 20 cu. ft. per hour.

Setting Cut Stone Using Power Derrick.—On large jobs it is advisable to use power derricks for the hoisting and handling of stone work, and the cost for rental of such derricks together with the cost of placing, etc., should be figured as a separate item. The gang to handle stone work by this method should consist of a mason, 2 helpers, 3 derrick men and from 4 to 6 laborers. Such a gang should set from 25 to 35 cu. ft. of stone per hour. When setting by this method, there will be more lost time in the changing of the derrick than when breast derricks are used.

Mortar.—The best mortar for setting limestone consists of one part hydrated lime or lump lime paste and not over three parts sharp, washed, clean sand, with the addition of stainless cement in an amount equal to 15 per cent of the lime used. If the building code in the city where the stone is to be used requires the use of cement mortar, the mortar should be made of non-staining cement with not more than

2½ parts of washed, clean sand to which should be added sufficient hydrated lime to render the mortar plastic under the trowel.

Anchors, Dowels, Clamps, Etc.—Anchors, clamps, Lewis hangers, dowels, etc., if made of iron or steel, should be galvanized. Ashlar anchors are usually of flat iron or steel and are $\frac{3}{16}$ or ¼ in. thick by 1 or 1¼ in. wide and should have one end bent down a scant inch into the stone and the other end bent up fully 2 in. into the backing. One anchor should be used for each face stone that has not at least one bed bonded to the backing by the masonry. Stone 3 ft. or more in length should have two anchors.

Cornice Anchors.—Special anchors for cornices, and belt course stones that do not have sufficient bearing to balance them on the wall, should be hooked into the stone fully 2 in. or more and should be spaced about 2 ft. apart, with at least two anchors to each stone.

Lewis Anchors.—Lewis Anchors are generally, ¾, ⅞ or 1 in. and should be galvanized.

Clamps.—Clamps for parapet copings and baluster rails are usually made of ¼- by 1¼-in. flat iron galvanized. They are made 6, 8, and 12 in. in length between ends. The ends are turned up from 1½ to 2 in.

Dowels.—Dowels are commonly made of ½-in. pipe cut 3 in. long. They are either of brass or iron. If of iron, they should be of black iron and be galvanized after they are cut to length.

Jointing of Stone.—All beds and vertical joints should have a maximum width of ¼ in. The mortar should be raked out ¾ in. from the face of the stone to allow for pointing. The ends of sills only should be bedded. All cornices, copings and projecting belt courses and all stones forming gutters, etc. should be set with vertical joints dry and caulked on the exterior with picked oakum. The joints should then be filled solidly with mortar grout composed of one part of non-staining cement and one part of fine white sand.

Backing Up and Stain Prevention.—The entire backs of all stones while wet should be plastered with not less than ½-in. coat of setting mortar before backing up. The first course of brick next to the stone facing should be laid in the same kind of mortar as that used for the setting of the stone.

Cleaning and Pointing.—The face of all stone work should be cleaned upon completion with soap powder boiled in clean water and applied with stiff fibre brushes. It should then be drenched with

clear water. The joints should be brushed out clean ¾ in. in depth, carefully removing all wedges. After a thorough wetting of the stone, they should be pointed flush with mortar consisting of one part of stainless cement, two parts of clean white sand and sufficient lime putty to make as stiff a mixture as can be worked.

Labor to Point Cut Stone.—The time required to rake out joinst and tuck point stone will vary considerably, but for average ashlar a man should be able to do about 25 to 30 sq. ft. per hour.

Labor to Clean Cut Stone Work.—A man can wash and clean about 50 sq. ft. of stone work per hour. Where the washing and pointing are done at the same time a man will do from 18 to 25 sq. ft. per hour.

GRANITE

Granite.—There is no uniform method in use for estimating granite work, and so many variable elements enter into the quarrying and manufacturing of granite, that it is difficult to make a tabulation of unit prices which will apply. To secure even an approximate price, it is necessary to make as detailed an estimate as possible of the work required. A price can then be applied in determining the total approximate cost. Each stone or group of like stones should be figured separately by applying the proper cutting unit to each face, head, mold, check, wash, bed, joint, etc.

The following method summarizes the general practice of building granite estimators, and by its use costs may be approximated by applying the units tabulated, assuming that proper judgment is employed in selecting the range of units for the kind of granite required.

Method of Estimating Granite.—First, a detailed schedule of quantities should be prepared. The best results will be obtained from the most accurately and completely detailed schedules. In taking quantities the dimensions are taken to cover the least rectangular content of the stone. The duodecimal system is almost universally used in cubing, and fractions of an inch are raised to the next full inch in recording the dimensions and cubes. It is the general practice to cube no stone as less than 1 cu. ft. per lineal foot, nor as less than 8 in. thick if less than 2 ft. high, nor less than 1 ft. thick when the height is 2 ft. or more.

Second, the unit values are applied to the quantities scheduled, following generally the procedure below:

Plane Work:

(*a*) Plane exposed faces: Figure the square feet at the surface cutting unit for grade of the cut specified.

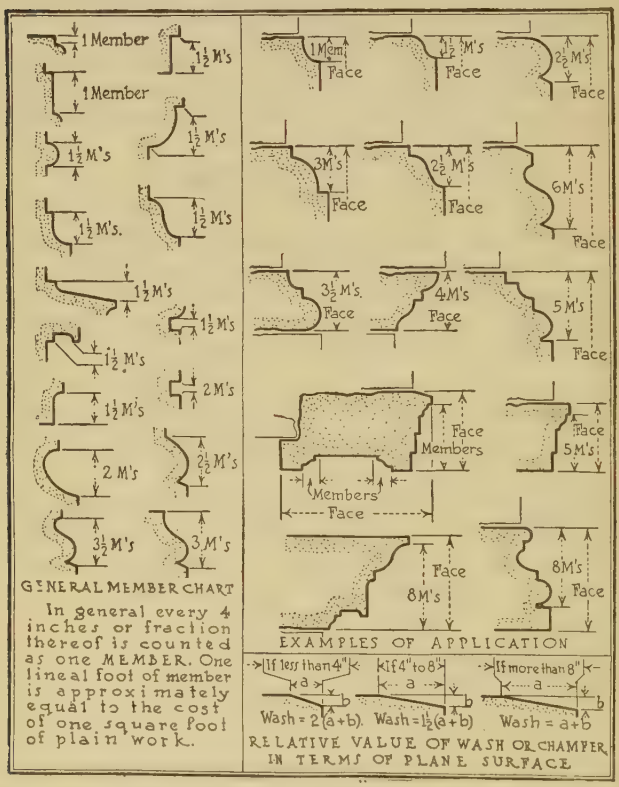


FIG. 1.—Units used as basis for estimating cost of granite mouldings.

(*b*) Heads or reveals: Figure the square feet at one and one-half times the proper cutting unit.

(*c*) Plane beds and joints: Figure as not less than 1 ft. wide, square feet at the bed and joint unit.

Molded Work:

(*a*) Square the face of the molded stone and figure at the surface cutting unit for grade of the cut specified.

(*b*) Estimate the number of equivalent members (see member chart), and figure number of members at member unit times the length of the membered portion of the stone.

(*c*) Beds and joints: Figure the same as on plane work.

(*d*) Molded heads: Figure the square feet of head at one and one-half times the surface cutting unit; figure the number of members at the member unit times the length of the longest member, in no case less than 1 ft.

(*e*) Breaks in molds: Figure the members as double the length of the longest member, but in no case less than 1 ft.

Miscellaneous:

(*a*) Washes—ordinary: 8 in. on or over, add drop of wash to width of wash, and figure as equivalent plane surface at the surface cutting unit.

(*b*) Chamfers: Figure the same as washes.

(*c*) Washes with lugs or seats: Figure actual surface over all at one and one-half times the surface of the cutting unit.

(*d*) Checks or rabbets: See table of Fine Rabbets.

(*e*) Circular work: Ordinarily figure as equivalent to one and one-half times straight work, varying more or less as the radius of curvature is smaller or greater.

(*f*) Checking for steel: Must be figured according to judgment and experience. This work in many cases amounts to considerable and must never be overlooked.

(*g*) Roughing for carving: must be figured according to experience, and depends largely on the character of the models.

Columns:

The ordinary method of figuring columns is as follows:

(*a*) Figure surface as equivalent to five times the greatest diameter, times the height at the proper surface cutting unit.

(*b*) Figure the beds as square at the surface cutting unit.

(*c*) Fillets and moldings: Figure as members the length taken as equivalent to five times the diameter.

(*d*) Flutes: Variable according to width, relative depth, and type of nosing. For rough approximating, figure no flute as less

than two and one-half members. Figure a medium depth Corinthian flute as two and one-half members if 4 in. wide or less; figure a deep flute as three and one-half members if 4 in. wide or less; flutes wider than 4 in. increase in proportion over a 4-in. flute; figure a flat Doric flute as one and one-half members for each 4 in. of flute surface or fraction thereof.

Polished Work:

(*a*) Plane Surfaces: If large enough to polish by machine, figure the square feet at plane polished surface unit.

(*b*) Members: Figure first as eight cut, then add for hand polishing each equivalent member at the polished member unit. Polished members should not be counted as over 2 in. wide.

(*c*) Polished work not included under plane machine work or members may be approximated at twice the cost of eight cut.

Double Faced Stone.—Figure first face as in plane cut work, and opposite side at one and one-half the surface cutting unit.

Schedule of Units.—These units are all f.o.b. producing plant, and are intended to cover approximately the range for the more generally accepted building granites and are for building work only. These units are based on granite cutters' wages at $8 per 8-hr. day. Present wage agreements with the granite cutters at the quarry centers contemplate $8 per 8-hr. day as the minimum wage to April 1, 1924. In using these units, proper allowance should be made for any change in the existing rate over or under the $8 rate.

Rough dimension stock—$1.25 to $2.50 per cubic foot.

Plane surface cutting units:

Medium pointed	$1.20 to $1.60 per surface foot
Four cut	1.50 to 2.00 per surface foot
Six cut	1.75 to 2.35 per surface foot
Eight cut	2.00 to 2.70 per surface foot

Member Units:

Coarse cut	$1.25 to $1.75 per lineal foot
Fine cut	1.50 to 2.00 per lineal foot

Bed and joint units:

Regular Commercial—65 to 95 cts. per square foot.

If better than regular commercial beds and joints are called for, increase the above units accordingly.

Plane polished face units:

Machine polished from rough—$2.35 to $4 per square foot

Polished member units:

Figure as not over 2 in. wide.

First figure as eight.

Then add for polishing—$1.65 to $2.95 per lineal foot of member.

Table of Fine Rabbets

Inches	1 in.	2 in.	3 in.	4 in.	5 in.	6 in.
1	$1.85–$2.80	$2.00–$3.00	$2.15–$3.20	$2.25–$3.40	$2.40–$3.60	$2.55–$3.80
2	.....	2.15– 3.20	2.25– 3.40	2.40– 3.60	2.55– 3.80	2.70– 4.00
3	.....	.....	2.55– 3.80	2.70– 4.00	2.80– 4.20	2.95– 4.40
4	.....	.....	.....	3.10– 4.60	3.20– 4.80	3.35– 5.00
5	.....	.....	.....	.....	3.75– 5.60	3.85– 5.80
6	.....	.....	.....	.....	.....	4.45– 6.65

The above method and units include practically all that enters into a granite contract, f.o.b. producing plant, except carving, models and turned work. The so-called "lumping charges," overhead, and incidental expense have been included in the cutting units.

No data can be given on carving, as its value is entirely dependent upon the models, character of work required, and the carving qualities of the granite to be used. Judgment and experience enter here to an even greater degree than in the determining of cutting values.

Balusters, columns, and round work may be cut by hand, and their value determined approximately by use of the above method, but where it is possible to utilize lathes for such work, a material saving will result both in time and expense. No general data is available for turned work.

Freight, hauling, setting, cleaning, and pointing will have to be added to the above approximate f.o.b. plant figures.

Freight depends entirely on the location of the quarry and of the job. For rough approximations, a rate of $4 per net ton might be used on freight from New England quarries to closely adjacent points outside of New England, and from New England points to Chicago, $5.25 on cut work, and $6 on polished work. These rates should be applied to carload shipments only, and in calculating

Classification of Building Granites

Quarried and cut by association members

(White, gray, lavender, pink, red, green, buff, brown)

Name of granite	Producer and manufacturer	Location of quarry	Grain	Color	Technical classification
Bethel White	Woodbury Granite Co., Hardwick, Vt.	Bethel, Vt.	Coarse inclined to medium.	White–faintly mottled with gray.	Quartz-monzonite.
Mount Airy	North Carolina Granite Corp., Mt. Airy, N. C.	Mount Airy, N. C.	Medium.	Very light gray.	Biotite.
Mount Airy	Lemmerman & Hoffman Granite Co., Mt. Airy, N. C.	Mount Airy, N. C.	Medium.	Very light gray.	Biotite.
Mount Airy	Mt. Airy Granite Cutting Co., Mt. Airy, N. C.	Mount Airy, N. C.	Medium.	Very light gray.	Biotite.
Mount Airy	J. D. Sargent Granite Co., Mt. Airy, N. C.	Mount Airy, N. C.	Medium.	Very light gray.	Biotite.
North Jay	Maine & New Hampshire Granite Corp., North Jay, Me.	North Jay, Me.	Fine.	Very light gray.	Biotite-muscovite.
Chelmsford Gray	H. E. Fletcher Co., West Chelmsford, Mass.	West Chelmsford, Mass.	Fine and medium.	Light gray.	Muscovite-biotite.
Milford, N. H.	Lovejoy Granite Co., Milford, N. H.	Milford, N. H.	Fine inclined to medium.	Light gray.	Quartz-monzonite.
Concord	John Swenson Granite Co., Concord, N. H.	Concord, N. H.	Fine to medium.	Light to medium gray.	Muscovite-biotite.
Connecticut White	Booth Bros. & Hurricane Isle Granite Co., 208 Broadway, New York, N. Y.	Waterford, Conn.	Fine.	Medium buff gray, hammers light.	Quartz-monzonite.
Westerly Blue-white	New England Granite Works, Westerly, R. I.	Westerly, R. I.	Fine.	Bluish gray.	Quartz-monzonite.
Woodbury Gray	Woodbury Granite Co., Hardwick, Vt.	Woodbury, Vt.	Medium.	Medium gray.	Biotite.
Rockport Gray	Rockport Granite Co., Rockport, Mass.	Rockport, Mass.	Medium to coarse.	Medium gray, slight bluish-green tinge.	Hornblende.

Goss Pink.....	John L. Goss Corp., Stonington, Me.	Crotch Island, Stonington, Me.	Coarse.	Pinkish-lavender tinted, medium gray.	Biotite.
Conway Pink.....	Maine & New Hampshire Granite Corp., North Jay, Me.	Redstone, N. H.	Coarse.	Light pink mottled with large gray and small black spots.	Biotite.
Jonesboro.....	Booth Bros. & Hurricane Isle Granite Co., 208 Broadway, New York, N. Y.	Jonesboro, Me.	Coarse inclined to medium	Pinkish-gray.	Biotite.
Red Westerly.....	New England Granite Works, Westerly, R. I.	Westerly, R. I.	Medium inclined to coarse.	Reddish-gray speckled with black.	Biotite.
Moose-a-bec Red....	Rockport Granite Co., Rockport, Mass.	Jonesport, Me.	Coarse.	Dark reddish-gray with white and pinkish feldspar.	Biotite.
Rockport Sea-green..	Rockport Granite Co., Rockport, Mass.	Rockport, Mass.	Medium to coarse.	Dark olive-green-gray with black spottings.	Hornblende.
Conway-green.....	Maine & N. H. Granite Co., North Jay, Me.	Redstone, N. H.	Coarse.	Dark yellowish-greenish-gray with black spottings.	Biotite-hornblende.
Somes Sound.....	Booth Bros. & Hurricane Isle Granite Co., 208 Broadway, New York, N. Y.	Mt. Desert, Me.	Coarse inclined to medium.	Light grayish-buff.	Biotite.
Rockport Seam-face..	Rockport Granite Co., Rockport, Mass.	Rockport, Mass.	Medium.	Dark yellow-brown, bright rust-brown, light yellow-brown.	Hornblende.

tonnage, allowing for cut away. Use 13 cu. ft. as approximating one net ton.

Hauling varies greatly for different localities and for different locations in the same city with respect to rail delivery. Quotations in New York City, Philadelphia, and Chicago, in 1923, indicate that from 15 to 20 cts. per cubic foot should be allowed for hauling.

Setting, cleaning and pointing are generally lumped at a cubic foot value, which varies according to the location, the character of the job, and the relative thickness of the facing. One dollar per cubic foot for an average job is about the minimum under conditions in 1923, and this will vary according to local conditions upward to $1.50 in many cases.

In using the foregoing, it must be borne in mind that the result is at best only a rough approximation. The lower range units are intended to apply to the cheaper grades or faster working building granites, and the higher range to the more expensive or more difficult working granites. Between the two, it is assumed, will lie the usual run of granites ordinarily used for building work. As a general rule, the gray granites are more easily worked and will fall from midway to the lower range, and the colored granites are generally slower working, running from midway to the upper range. This does not always apply, however, as some fine-grained grays will fall in the highest range and some of the faster working colored granites will be found to run from the middle to lower range. A knowledge of the working qualities of the granite desired is necessary to determine what range to apply. It is essential to check carefully all the elements which enter into the total value of the completed work. The following items should all be included in the estimate: Stock, cutting, polishing, carving and models, turning, freight, hauling and setting, cleaning and pointing.

CAST STONE

It is very difficult to give any adequate unit prices for cast stone work. This is due to the variety of meanings given to the term "cast stone." It is sometimes used to mean concrete block and sometimes material slightly better with only a facing of imitation stone, while for the better grades of work it stands for a material that is in every way equal to and for some purposes superior to the natural stone. It is perfectly possible to imitate various natural stones with

a degree of accuracy that makes it difficult to recognize the artificial from the real. Where the job is properly laid out for the use of artificial stone, it may be safe to say that the price should be a little less, perhaps showing a saving of from 5 to 15 per cent over the same grade of natural products.

FIG. 2.

Perhaps the best description of artificial stone that has been given is that furnished in an interview with James G. Benedict, President of the Benedict Stone Corporation, appearing in the March, 1921, issue of the *Contractor's Atlas*. A part of this interview is as follows:

The term "cast stone" is very elastic and in a sense, meaningless. It has been employed for products which might more accurately be classified as a poor grade of concrete block, and at the same time it has been used for all the varying grades of the material up to the very highest types and most perfect products. The term "cast stone" in a specification is

really about as meaningless as the term "cloth" would be in a specification for a garment, or the term "brick" in a building specification, without any qualification as to the kind of cloth or the grade of brick. Cast stone of inferior grade has been produced for years and accepted by some architects and builders solely on account of the necessity for low cost and sometimes because of lack of a proper standard and the insistence upon living up to that standard.

Cut cast stone as made by the Benedict Stone Corporation (successor to Emerson-Norris Company of New York) is in many respects superior to natural stone in that it is more dense, stronger in tension because thoroughly reinforced with steel; and it is more fireproof than any quarried stone. It does not stain and discolor as do many natural stones. Its durability is unquestioned.

The stone is made from the same detail drawings as would be furnished to an ordinary stoneyard. All of the ornament is made from models supplied by the leading modelers in accord with the choice of the architects, and after the ornament is molded it is tooled by skilled carvers in the same manner as natural stone to give it all of the sharpness and beauty of detail possible in stone. The plain surfaces are given any of the various finishes common to natural stone. Practically all of the stone simulating natural granites is hand bush-hammered.

While as a rule the use of the *cut cast stone* is very much more economical than natural stone, there have been many cases where owing to special circumstances or features of design, natural stone has been lower in cost.

CHAPTER VIII

ARCHITECTURAL TERRA COTTA

Architectural terra cotta is a fire-resisting building material composed of a blend of high-grade clays mixed with a percentage of calcined clays or grit to control shrinkage and warping. This mixture is subjected to a temperature of about 2,200 deg. of heat. Terra cotta is used in building construction in the same way as limestone or granite. It is a general building material and can be manufactured in almost any color, glazed or unglazed, imitation granite, pulsichrome or polychrome. It allows the architect an unlimited field for color effects, and at the same time retains the modelers touch at a very reasonable cost.

Method of Manufacture.—After the shop drawings have been approved by the architect, plaster models are made. If plain, the mold is taken directly from the plaster model. If ornamental, the plaster model goes to the modeler who places on it whatever ornament is desired. When the mold is completed, it is sent to the pressing room where the soft clay is pressed into the mold. The freshly modeled clay, after being taken from the mold, is allowed to dry in the pressing room until white hard. It is then removed to dryers and is subjected to a temperature of about 150 to 200 deg. The reason for this is to remove as much microscopic water as possible. From the dryers the material proceeds to the spraying room where an under body and any coloring called for are applied. The material then proceeds to the kilns which use either coal or oil, and is there burned at a heat ranging from 2,200 to 2,300 deg. F. The usual shrinkage is about 1 in. per foot.

The time consumed in manufacture is approximately six weeks from the receipt of the architect's fully figured drawings. Of course this time will vary somewhat according to the time needed for drafting and modeling.

When pieces are repeated a large number of times, the cost of molds is somewhat reduced, but not entirely eliminated, as a mold can only

be used about 35 times. Duplicate molds are made, however, at a comparatively small cost, as they are taken from the original model.

Preparing the Estimate.—Before attempting to price terra cotta, it is necessary to take off a careful set of quantities. Each course should be figured so that the cubic quantity is easily ascertained. In cubing projecting courses, such as cornice members, belt courses, and cap pieces, use for the width of the member two-thirds of the projection plus the bearing, which multiplied by the other two dimensions, will give the cubical contents. The volume should be carried out in cubic feet and also in tons. The average weight of terra cotta is 66 lb. per cubic foot. A short method of changing cubic feet into tons is to divide by 30, the number of cubic feet per ton.

Pricing Terra Cotta.—There does not seem to be any definite unit for determining the price of terra cotta as so many different things enter into its cost, such as the number of pieces which can be made from a mold, the size and kind of mold, the amount of ornamentation and the color and finish. Because of these difficulties a price should always be obtained from the manufacturer when possible, particularly as the law of supply and demand has a decided effect on the price. However, it is possible to figure an approximate price for an average job, keeping in mind the various finishes. The surfaces, such as tooled, picked, antique, etc. do not make any difference in price.

Unglazed.—The present price per ton f.o.b. factory (September, 1923) is $130 per ton, or $4.33 per cubic foot.

Granite.—For this finish $5 per ton is added. The color such as gray or pink makes no difference in the price.

Glazed or Pulsichrome.—For these finishes 10 per cent is added.

Polychrome.—This work is sometimes done by atomizer and sometimes by hand brush. As this together with the number of colors per piece changes the price considerably, it is impossible to approximate the cost until actual conditions and colors required are known.

Models.—If models are to be furnished by a modeling company, their cost must be added to the above, as models furnished by such concerns do not as a rule save the terra cotta companies any work.

Fitting at the Job.—The foregoing prices do not include any fitting at the building. The terra cotta companies will furnish a competent man to do such fitting at the prevailing rate of wages, plus traveling expenses and board.

Cost of Setting.—This will vary in different localities but for an average job set by the usual run of good masons, it should cost about 10 per cent less than limestone. In most of our eastern cities with the present rates of wages, it costs about 75 cts. per cubic foot to set terra cotta except where cornices occur. For cornices the price will average $1. These prices include all labor and mortar but not backing up or wire anchors. For hoisting about $1 per ton is added.

Mortar and Pointing.—These items are the same as for limestone. (See Chapter on "Limestone.")

Cleaning Down.—The best material for this is dilute muriatic acid in proportion of about 1 to 20. A man will ordinarily clean about 600 to 1,000 sq. ft. per day. When the cleaning and pointing is done at the same time, the area covered will be about one-half the amount given above.

CHAPTER IX

TILE FIREPROOFING

While this material is among the best known fire-resisting materials used in building construction work, yet it is probably a misnomer to speak of it as fireproofing, for in many cases it performs a very important use in the structure other than that of fireproofing. While tile has been used almost since the dawn of civilization, it is only within the last 20 or 30 years that it has become an important feature in building construction work. It is now commonly used both for exterior and interior walls and partitions and also for flooring, roofing, furring, fireproofing, etc.

Weight of Hollow Tile Walls.—There are several grades of hollow tile running from a soft, porous material made for nailing blocks, etc. to a hard, vitrified hollow tile. The weight of a cubic foot of the various grades is from 40 to 50 lb., thus making a considerable saving in the weight of a structure as compared with the majority of other similar construction materials.

Strength.—The strength of any wall built of small pieces is dependent upon two factors: First, the material or units themselves, and second, the mortar or material used for cementing the units together. In the case of tile, the strength of the tile is usually greater than that of the mortar joints. A wall of hollow tile properly laid in a good cement and lime mortar will develop from 60 to 75 per cent of the strength of the tile. This is usually sufficient for the purpose for which the wall is intended.

Dryness.—The dryness of an exterior wall can be assured by having it lined with tile, as the tile is constructed in a way to leave air spaces. This prevents the outside cold from penetrating the wall and causing condensation. Hollow tile blocks are made of various thicknesses and are well adapted to back up brick and stone work. By using 4-, 8- and 12-in. tile, the brick and stone can be bonded to the tile thus insuring

a homogeneous wall. If a wall is a bearing wall and unusual strength is required, special tile can be had or tile used on end can be filled with concrete, thus making a solid wall that is capable of bearing heavy loads.

Tile to Support Stucco.—Stucco is being used more and more, but it does not enjoy the popularity that it might and would receive if it were always applied to a proper surface. When stucco is applied to wood laths, they usually swell and bulge, ruining the finished work. When it is applied to metal laths, they frequently rust and soon lose their grip and the material drops off. But when stucco is applied to hollow tile, the work can be made practically permanent and is as reliable as any other form of building construction. The tile of course does not shrink or swell. It is permanent, and with properly applied stucco makes a very attractive exterior for residences and other buildings.

Cement Mortar for Tile Work.—Hollow building tile should be set in cement mortar composed of one part portland cement with not more than three parts of clean sharp sand, to which may be added hydrated lime not exceeding 15 per cent by volume of the cement. The percentage of lime added is always figured on the quantity of the cement used.

The lime specified is to make the mortar more plastic and easier to handle. Mortar containing lime will adhere better to the tile, makes a neater job and results in a saving of labor. Too much lime must not be used as it weakens the mortar. A straight lime mortar, however rich the mixture, is not suitable for setting hollow tile. A sand containing an appreciable quantity of loam must not be used for cement plastering or stucco. Sand containing a little clay may be used if the grains are not coated.

The table gives the quantities of mortar materials required to lay up 1,000 pieces (not square feet) of hollow tile of the various sizes given. This table allows about 10 per cent for waste and is based on the mixture that is recommended for hollow tile construction, consisting of one part portland cement and three parts sand, to which 15 per cent of hydrated lime or of lime putty is added.

For the convenience of builders the table gives the quantities of lime both by measure and by weight for lump lime and by weight for hydrated lime.

TABLE OF QUANTITIES FOR CEMENT MORTAR
Materials required to lay 1,000 pieces of hollow tile
(Barrel of cement specified to be 3.8 cu. ft.)

Size of tile	Thickness of wall, inches	Approximate quantity of mortar, cubic feet	Mortar materials required				These quantities for ordering lump lime in pounds
			Cement sacks	Sand, cubic feet	15 per cent dry hydrated lime, pounds	15 per cent lump lime paste, cubic feet	
4 by 5 by 12	4	19.66	6.28	19.65	38	0.94	28
5 by 4 by 12	5	23.12	7.36	23.11	44	1.10	33
5 by 8 by 12	5	28.91	9.24	28.89	55	1.38	42
8 by 5 by 12	8	39.33	12.56	39.31	75	1.88	56
4 by 5 by 12 8 by 5 by 12	12	59.02	18.88	59.02	113	2.83	85
4 by 12 by 12	4	27.75	8.92	27.72	54	1.34	40
6 by 12 by 12	6	41.66	13.32	41.66	80	1.99	60
8 by 12 by 12	8	55.54	17.76	55.53	107	2.66	80
12 by 12 by 12	12	83.33	26.64	83.32	160	3.99	120
					A	*B*	*C*

Use either column *A* or *B*. Column *A* is for dry hydrated lime. Column *B* is for lump lime. Column *C* gives the approximate quantity of lump lime required to make the amount of lime paste given in column *B*.

A barrel of lump lime containing approximately 3 cu. ft. and weighing 180 lb. net, will produce about 6 to 6.5 cu. ft. lime paste which, on account of the water added, will weigh about 70 lb. per cubic foot.

In giving the size of tile, the first number always indicates the thickness of the wall, the second the width of the tile and the third the length to which it is cut. A cubic foot of hydrated lime weighs 40 lb. A cubic foot of cement weighs 100 lb. Therefore at 15 per cent there will be 6 lb. of hydrated lime to add to each cubic foot of cement.

FLAT ARCH LINTELS

For all lintels over single windows or doors in walls built of any tile with courses 8 in. or more in height, the simplest form of lintel is the flat arch cut from the same tile that is used in the wall, as shown by Fig. 1.

With this form of lintel, the heads of frames should be temporarily braced, and should always have proper abutment to resist the thrust. These flat arch lintels should not occur too close to the corners of walls or be supported on slender piers. The corner piers should not be less than 3 ft. wide. In all cases where they must be used near corners, a reinforcing tie of strap iron or woven wire should be bedded in cement mortar in the joint beneath, as shown in the illustration, and should be turned up into the vertical joints for anchorage.

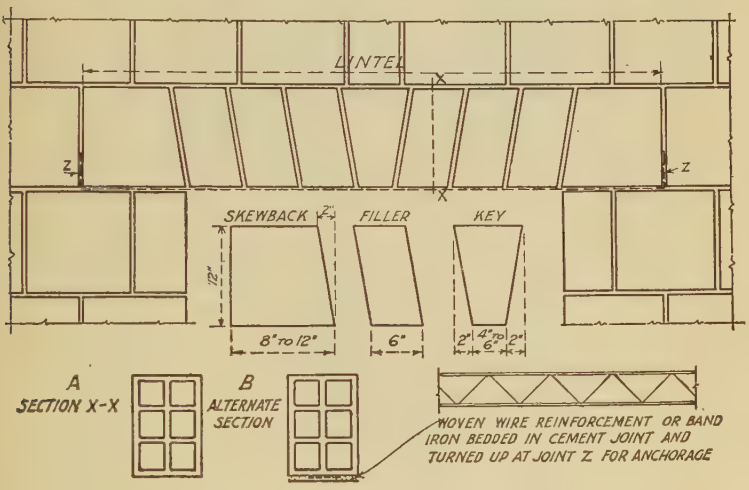


FIG. 1.

When ordered along with the straight wall tile, the cost of such lintels is but slightly more than regular square foot price of the tile shapes from which they are made.

SPECIFICATION NOTES ON COMBINATION HOLLOW TILE AND CONCRETE FLOORS

General.—In general, combination hollow tile and concrete floor construction consists of reinforced concrete joists between rows of hollow tile. All tile are covered with a concrete top, cast monolithic with a concrete joist. All floor slabs should have at least 4-in. bearing on the walls.

Concrete.—All concrete used in the floor construction shall consist of one part approved portland cement, two parts clean sharp sand and four parts broken stone or gravel of such size as will pass through ½-in.

SAFE SUPERIMPOSED LOADS IN POUNDS PER SQ. FT. FOR COMBINATION TILE AND CONCRETE FLOORS

UNIT STRESS IN STEEL 18,000 LBS. UNIT STRESS IN CONCRETE 700 LBS.

WL / M=12	4"x12"x12" Tile, 16" Centers 1½" Concrete Top Weight floor per sq. ft., 43 lbs. Concrete per sq. ft., .208 cu. ft. Tile per sq. ft., .75 sq. ft.					6"x12"x12" Tile, 16" Centers 2" Concrete Top Weight Floor per sq. ft., 60 lbs. Concrete per sq. ft., .292 cu. ft. Tile per sq. ft., .75 sq. ft.					8"x12"x12" Tile, 16" Centers 2½" Concrete Top Weight floor per sq. ft., 76 lbs. Concrete per sq. ft., .333 cu. ft. Tile per sq. ft., .75 sq. ft.					10"x12"x12" Tile 17" Centers 3" Concrete Top Weight Floor per sq. ft., 99 lbs. Concrete per sq. ft., .495 cu. ft. Tile per sq. ft., .706 sq. ft.					12"x12"x12" Tile, 18" Centers 3½" Concrete Top Weight Floor per sq. ft., 120 lbs Concrete per sq. ft., .625 cu. ft. Tile per sq. ft., .667 sq. ft.					WL / M=12
n=15																										n=15
p	.00322	.00385	.00445	.00620	.00694	.00249	.00350	.00446	.00653	.00704	.00229	.00405	.00517	.00689	.00756	.00137	.00357	.00598	.00680	.00762	.00466	.00529	.00693	.00695	.00778	p
Values k	258	286	300	348	361	235	274	305	331	366	267	293	324	340	374	333	333	344	360	376	311	326	344	364	380	Values k
	914	903	890	884	888	922	909	898	890	878	911	902	892	887	875	899	889	885	880	875	896	891	885	879	873	
Reinforce't Each Rib	2-½"ø	2-½"□	2-½"ø	1-1"ø 1-½"□	2-½"□	2-½"□	2-½"□	2-½"ø	2-½"ø	2-½"□	2-½"□	2-½"ø	2-½"□	2-½"□	2-½"□	2-½"ø	2-½"□	2-½"ø	1-1"ø 1-½"□	2-½"□	2-½"ø	1-1"ø 1-½"□	2-½"□	1-1"ø 1-½"□	2-½"□	Reinforce't Each Rib
10	81	113	169	197	236	187	277	364	451	577	508	636														10
11	59	86	132	155	179	144	218	290	362	466	406	513														11
12	43	65	104	123	144	110	174	234	295	382	329	419														12
13	30	49	82	99	116	86	139	191	242	317	269	346														13
14		36	65	79	94	66	112	156	200	265	222	288														14
15		26	51	63	77	50	90	128	167	223	183	241	324	365							700					15
16			40	51	62	37	71	106	140	189	152	202	275	312		433	566				603	697				16
17			30	40	50	26	56	86	117	160	126	170	236	267		368	485				520	603				17
18				31	40		44	71	98	136	104	144	202	230		315	419	453			451	522	598			18
19					32		33	57	81	116	85	121	173	199	258	270	363	393			392	459	524			19
20								46	68	99	70	102	149	172	226	233	315	343	401		342	402	462			20
21								34	56	84	56	85	128	149	198	200	275	300	352	383	299	354	407			21
22									46	72	44	71	110	129	173	172	241	263	310	338	262	312	360	434		22
23									37	60	34	58	94	112	152	149	210	230	274	299	229	275	320	387	414	23
24									29	50	25	47	80	96	133	127	184	202	242	265	201	243	284	346	371	24
25										42		38	68	82	117	109	160	178	214	235	176	214	252	309	332	25
26										34		29	57	70	102	93	140	157	190	209	153	189	224	277	298	26
27													47	60	90	78	122	137	168	186	133	167	199	248	268	27
28													39	50	78	65	106	120	149	165	116	146	177	222	241	28
29													31	41	67	54	92	105	131	147	100	128	156	199	216	29
30														34	58	43	79	91	114	130	85	112	138	178	194	30

SPAN IN FEET

SPAN IN FEET

Note: This table is based on $M=\frac{WL}{12}$ Top steel over support for negative "M" same area as for positive "M" at center of span. Top steel over support to extend at least ¼ of span length. Top shell of tile figured as a part of flange. Neutral axis in flange. Shear computed on basis that the tile adds 1½" to the width of the concrete ribs. The maximum shear for loads below and to the left of the heavy line does not exceed 60 lbs. per sq. in.

For end spans, when $M=\frac{WL}{10}$ use ⅘ of total superimposed load and dead weight of floor.

For simple spans, when $M=\frac{WL}{8}$ use ⅔ of total superimposed load and dead weight of floor.

Loads above and to the right of the heavy line should be used only for computing loads for end or simple spans.

Provide ¾" of concrete under the reinforcement.

FIG. 2.

Combination Tile and Concrete

Cubic feet concrete per square foot of floor

Size of tile	4-in. joist					5-in. joist					6-in. joist				
	1½-in. top	2-in. top	2½-in. top	3-in. top	3½-in. top	1½-in. top	2-in. top	2½-in. top	3-in. top	3½-in. top	1½-in. top	2-in. top	2½-in. top	3-in. top	3½-in top
3 by 12 by 12	0.187	0.229	0.271	0.312	0.354	0.199	0.241	0.282	0.324	0.366	0.208	0.250	0.292	0.333	0.375
4 by 12 by 12	0.208	0.250	0.292	0.333	0.375	0.223	0.265	0.306	0.348	0.390	0.236	0.278	0.320	0.361	0.403
5 by 12 by 12	0.229	0.271	0.313	0.354	0.396	0.248	0.290	0.331	0.373	0.415	0.264	0.306	0.348	0.389	0.431
6 by 12 by 12	0.250	0.292	0.334	0.375	0.417	0.272	0.314	0.355	0.397	0.439	0.291	0.333	0.375	0.416	0.458
7 by 12 by 12	0.271	0.313	0.355	0.396	0.438	0.296	0.338	0.379	0.421	0.463	0.319	0.361	0.403	0.444	0.486
8 by 12 by 12	0.291	0.333	0.375	0.416	0.458	0.321	0.363	0.404	0.446	0.488	0.347	0.389	0.431	0.472	0.514
9 by 12 by 12	0.312	0.354	0.396	0.437	0.479	0.346	0.388	0.429	0.471	0.513	0.375	0.417	0.459	0.500	0.542
10 by 12 by 12	0.333	0.375	0.417	0.458	0.500	0.370	0.412	0.453	0.495	0.537	0.402	0.444	0.487	0.527	0.569
12 by 12 by 12	0.375	0.417	0.459	0.500	0.542	0.419	0.461	0.502	0.544	0.586	0.458	0.500	0.543	0.583	0.625

ring. It shall be a moderately wet mixture and must be well spaded and worked around the reinforcing steel after pouring. The placing of concrete must be a continuous operation and the full depth of floor must be poured at one time. All tile must be wet before concrete is placed so as to insure a good bond. When the slab cannot be completed in a single operation, the work shall be stopped along the center of a row of tile with a vertical joint. In pouring the ribs the concrete should not be dumped into the joist, but on the previously placed concrete and worked forward, allowing the mortar to flow ahead in the joist.

Reinforcing Steel.—Deformed or cold twisted bars, offering a mechanical bond with the concrete, are to be used as reinforcing for the floor construction. They shall be free from mill or rust scales. The reinforcing should be placed so as to allow at least a ¾-in. covering of concrete on all sides.

Tile.—The depth of the hollow tile and the size of the reinforcing steel are determined by the span and the load to be carried as indicated on the structural drawings. The hollow tile should be hard burned, free from damaging imperfections and properly scored on all exterior surfaces. The joints between the tile and adjacent rows should be staggered by starting each alternate row with a half-length tile.

Forms.—Forms must be of such size lumber and so braced as to prevent deflection and must be provided in such quantity as not to delay the progress of the work. Care must be taken not to remove the forms before the concrete is set. Under long spans the center row of supports must be maintained for at least three weeks after the concrete has been poured. In cold weather, the contractor must leave the forms in place until directed by the architect to remove them. No concrete shall be poured when the temperature is below freezing unless provision has been made for heating and protecting the work.

TIME TO HANDLE AND SET TILE FIREPROOFING—MASON AND HELPER

MATERIAL	HOURS TO SET 100 SQ. FT.
2-in. split furring	3.0
3-in. partitions	3.0
4-in. partitions	3.2
5-in. partitions	4.0
6-in. partitions	4.5
7-in. partitions	5.0
8-in. partitions	5.5
9-in. partitions	6.0
10-in. partitions	6.5
12-in. partitions	7.0
booktile 24 in. long	2.6
8-in. exterior walls	6.0

Fireproofing Around Columns and Pipe Chases.—The time for setting tile around square columns and pipe chases depends largely on their size. For columns of 2 ft. and over, a mason and a helper should be able to set 100 sq. ft. of 3- or 4-in. blocks in 4 hr., while for columns on which each block has to be cut, it will take from 6 to 8 hr. Fire-

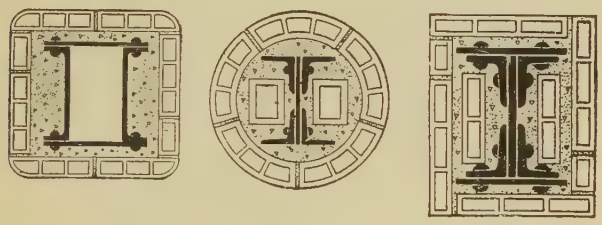


FIG. 3.

proofing of round columns usually requires about 10 per cent more time than for square.

Tile, Beam and Girder Covering.—Hollow tile is made in various forms for beam and girder covering and is shaped to fit the flanges of

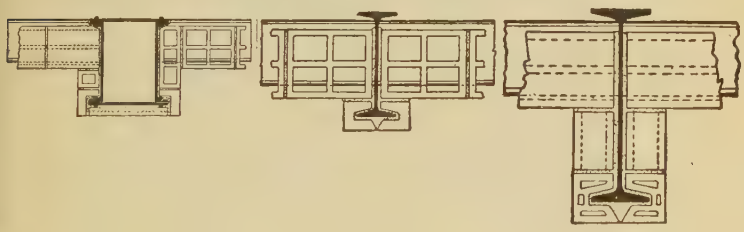


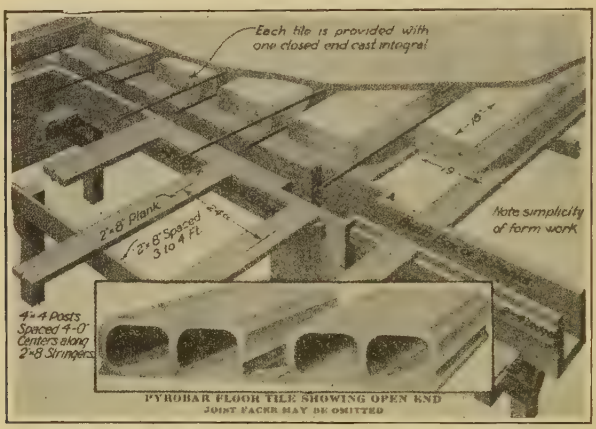
FIG. 4.

all standard steel beams and girders. It is self-supporting except when the width of the girder is more than 12 in. when the soffit should be supported by metal clips.

Time to Install Girder Covering.—The time required for a man and a helper to set 100 lin. ft. of the two sides and bottom of an ordinary beam or girder covering is about 6 hr.

PYROBAR FLOOR TILE

Description.—Pyrobar Floor Tiles are made of "Structolite," a dense, specially prepared gypsum. They are cast in steel molds and are uniform in size, 19 in. wide 18 in. long by 6, 8, 10 or 12 in. deep.



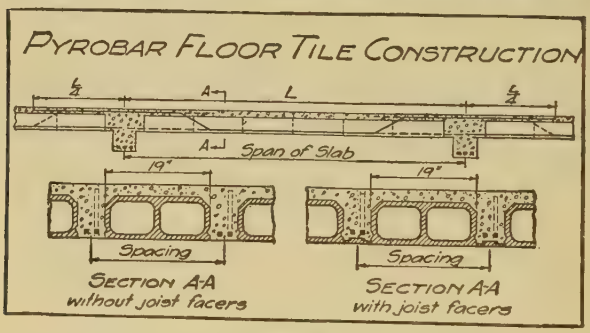


FIG. 5.

All tile are cast with one end piece integral, thus providing a seal for each row at the girders. Joist facers are made in standard widths of 5 in. and are 1 in. thick and 12 in. long. Special widths of facers will be made where the design calls for joists of greater width. A special feature of these facers is the dovetail which assures the positive anchorage of the facer to the concrete.

Advantages Claimed by the Manufacturers.—Pyrobar Floor Tiles are light in weight, and a saving in reinforcing steel is assured when these tiles are used. Formwork is reduced to a minimum. Spans up to 30 ft. in length are permissible with this system where light floor loads are involved. The strength of the concrete is increased, because the tile absorb a certain amount of water from the concrete when it is poured and then gradually return this moisture as the concrete sets and dries. Pyrobar Floor Tile act as a very efficient sound-deadener. A uniform plastering base without the use of a suspended ceiling is obtained by using joist facers between the tile. This gives a uniformly smooth ceiling surface of gypsum, ready for plastering.

The following cuts illustrate the method of installing this type of floor, and also shows the ease of constructing the forms.

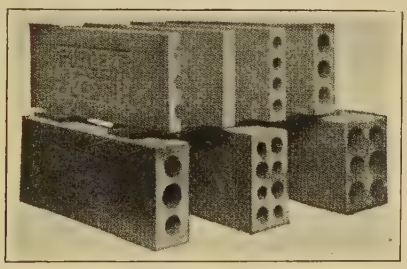


Fig. 6.

GYPSUM TILE

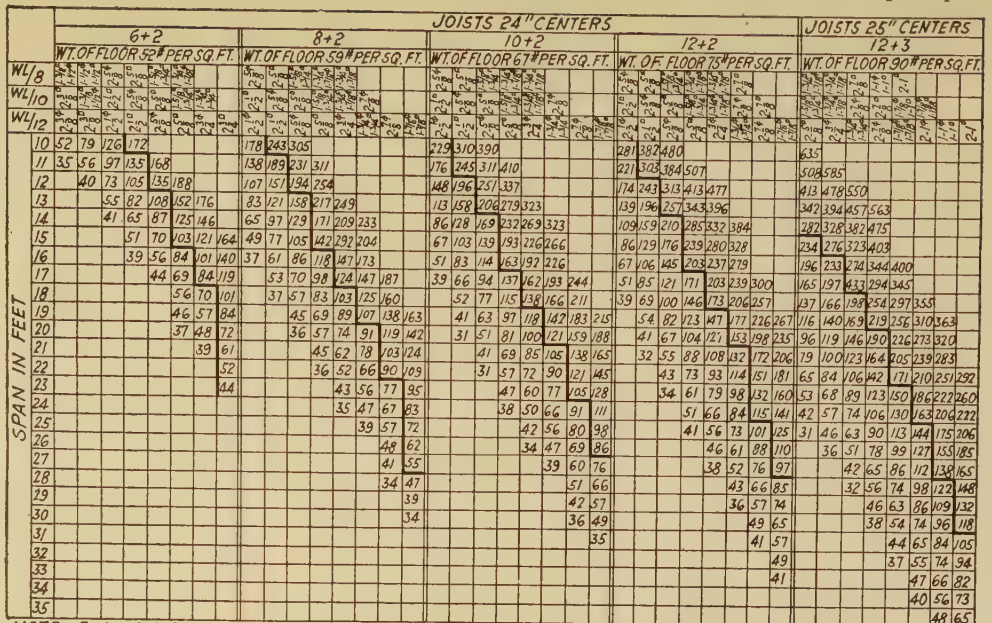
Partitions and Furring.—Gypsum tile for partitions and furring is made in standard face dimensions: 12 by 30 in. in both solid and hollow types, and of various thicknesses to meet underwriters' standards, architects' specifications and the building laws of the various cities. A table of sizes and weights is given below. The thickness of the partition is determined primarily by the ceiling height and by its location in the building. As a rule, 3- or 4-in. tile is the size used for the average building where partitions do not exceed 15 ft. in height. Corridor partitions are generally thicker than cross partitions. Two-inch solid tile is used for partitions not exceeding 10 ft. in height, for covering columns and for constructing pipe chases, vent ducts, dumb-waiter shafts, etc.

Safe Superimposed Loads in Pounds per Square Foot
Pyrobar Floor Tile Construction

Steel stress 16,000 lb. per sq. in. Without facers Concrete stress 650 lb. per sq. in

SPAN IN FEET	JOISTS 24" CENTERS																																JOISTS 25" CENTERS									
	6+2								8+2								10+2								12+2								12+3							
	WT. OF FLOOR 54# PER SQ. FT.								WT. OF FLOOR 60# PER SQ. FT.								WT. OF FLOOR 68# PER SQ. FT.								WT. OF FLOOR 76# PER SQ. FT.								WT. OF FLOOR 92# PER SQ. FT.							
WL/8	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"
WL/10	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"
WL/12	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"	2'-5"	2'-6"	2'-7"	2'-8"	2'-9"	2'-10"	2'-11"	3'-0"
10	62	93	148	212					201	272	343						253	342	430						306	412	522						684							
11	42	67	113	158	198				156	215	260	350					197	271	344	457					240	328	418	550					549	631						
12	26	48	87	124	158	218			122	170	219	285	360				163	216	279	372					189	264	340	449					447	515	594					
13		33	65	97	126	177	206		95	136	178	232	282				122	174	227	307	355				150	213	274	372	430				368	425	493	608				
14		21	49	77	102	146	171		73	110	145	193	234	273			96	138	186	256	296	348			119	173	229	310	360	417			304	355	413	511				
15			36	60	82	120	141	193	57	87	119	160	196	231			74	114	154	214	249	293			101	141	190	260	304	355			253	298	348	434				
16			25	46	65	99	118	164	42	70	97	134	165	195			57	92	128	180	211	249			73	115	158	220	258	302			212	252	296	370	430			
17				35	52	81	99	139	31	55	80	111	140	167	211		43	73	105	152	179	213	269		57	93	131	186	220	259	326		178	213	251	318	372			
18				25	43	67	82	118	21	42	65	94	118	142	181		31	58	86	128	152	182	232	272	42	75	109	158	188	222	282	331	148	179	214	274	321	384		
19					30	54	68	100		32	51	78	100	121	156	185	21	46	70	108	130	157	202	238	30	59	90	134	160	192	246	290	125	152	183	237	280	335		
20					22	44	56	85		24	40	64	84	104	136	160		34	56	90	111	135	176	208		46	73	113	138	166	214	255	104	128	157	205	243	294	346	
21						35	46	72			32	53	71	89	117	140		24	45	76	94	116	152	182		35	60	96	118	146	187	224	86	108	134	178	221	258	305	
22						27	37	61			24	42	59	75	102	123			35	64	80	100	134	160			48	80	101	124	164	197	70	94	114	154	186	227	271	
23							30	52				34	49	64	88	107			26	52	67	86	116	141			38	67	86	107	144	174	57	74	104	133	162	200	240	280
24							22	43				26	40	54	76	90				42	56	73	101	123			28	56	73	92	124	153	45	62	81	115	141	176	213	250
25								35					32	45	61	82				33	47	62	88	109				45	61	80	107	136	34	50	68	98	123	157	189	224
26								29					25	47	56	72					38	52	76	96				36	50	67	92	120		40	55	85	106	131	168	200
27								22						39	48	62					30	43	66	84				28	40	57	80	105		30	46	72	93	122	150	178
28														24	40	53					24	36	56	73					33	48	67	93			35	61	81	102	133	160
29															33	45						29	47	64						39	57	81			50	68	93	118	143
30															27	39						22	41	55						32	48	71			41	58	81	104	128
31																32							33	47							39	62			32	49	70	91	114
32																26								39							32	53				40	60	80	102
33																								33								46					32	51	71	89
34																																39						43	61	80
35																																						35	52	70

Steel stress 16,000 lb. per sq. in. With facers Concrete stress 650 lb. per sq. in.



NOTE:-For loads to left of heavy lines shear is less than 60# per square inch and is provided for by concrete and bent bar in joist. For loads to right of heavy lines shear is greater than 60# per square inch and requires shear reinforcement.

FIG. 7.

Split and hollow gypsum tile furring is laid against exterior walls and securely spiked every square yard. Joints should be broken the same as for partition work. Furring may also be fastened to the building wall by means of wall ties. The hollow portion of the tile should be placed against the wall, thus minimizing the contact area with the outside walls. Where furring stands free from the wall, allowing space for pipes, vents, etc., it is customary to use 2-in. solid, 3-in. hollow or 4-in. hollow gypsum tile, as more rigidity is required. Free standing furring is anchored to the exterior wall either by running dwarf walls between the furring and exterior wall, or by imbedding corrugated metal wall ties in the exterior wall of sufficient length so that they can be imbedded in the joints between the tile.

FIG. 8.

Pyrobar Beam, Girder and Column Covering.—Pyrobar tile, used for fireproofing steel beams, is a combination of special gypsum shoe tile and standard Pyrobar partition tile. Columns are usually covered with standard solid or hollow Pyrobar partition tile. The shoe tile is molded to conform with the steel shapes.

Labor to Install.—A man and a helper will install 100 lin. ft. of beam or girder protection in from 4 to 5 hr.

STANDARD PYROBAR GYPSUM PARTITION TILE

	For ceiling heights up to	Weight tile, in place square foot, pounds	Weight mortar per square foot, pounds	Total weight plastered one side per square foot, pounds	Total weight plastered two sides, per square foot, pounds
1½-in. split—1½-by 12-by 30-in.	Furring	4.9	1.0	7.9	10.9
2 -in. split—2-by 12-by 30-in.	Furring	6.4	1.0	9.4	12.4
2 -in. solid—2-by 12-by 30-in.	10 ft.	9.4	1.0	12.4	15.4
3 -in. hollow—3-by 12-by 30-in.	13 ft.	9.9	1.2	12.1	15.9
3 -in. solid—3-by 12-by 30-in.	15 ft.	13.0	1.2	16.0	19.0
4 -in. hollow—4-by 12-by 30-in.	17 ft.	13.0	1.63	16.0	19.0
5 -in. hollow—5-by 12-by 30-in.	25 ft.	15.6	2 04	18.6	21.6
6 -in. hollow—6-by 12-by 30-in.	30 ft.	16.6	2.45	19.6	22.6
8 -in. hollow—8-by 12-by 30-in.	40 ft.	22.4	3.26	25.4	28.4

MORTAR REQUIREMENTS PER 1,000 SQUARE FEET
Based on a mix of 1 part plaster to 3 parts sand by weight

	1½-in. F.	2-in.	3-in.	4-in.	6-in.	8-in.
Sacks plaster	4.0	5.0	6.0	7.0	9.0	10.0
Yards sand	0.5	0.6	0.75	1.0	1.5	1.75

Time to Set Gypsum Tile.—The labor required to set gypsum tile is considerably less than that required to set clay tile because of the somewhat lighter material and the larger blocks, the usual size of gypsum tile blocks being 12 by 30 in., while the ordinary clay tile block is 12 by 12 in. For this reason a man handles and sets 2½ sq. ft. at a time instead of 1 sq. ft. It is also easier to cut gypsum blocks than it is to cut hollow tile as they can be sawed to any desired size with an ordinary saw.

Mason's Helpers.—Because of the increased speed of placing gypsum tile, it is economical to employ more helpers than masons, the usual number being about 5 helpers to 4 masons, or 1¼ times the number of masons.

In some of the large cities the setting of gypsum tile has been made a special trade and sub-contractors have handled this work. In this way they have been able to develop gypsum tile setters who can do about 25 per cent more than the average mason. On large jobs this has proved economical, but as sub-contractors must take their profit, on ordinary work there is little or no saving to the general contractor in subletting the work.

LABOR FOR SETTING 100 SQ. FT. GYPSUM TILE

	Mason	Helper
2-in. furring	2.0	2.5
3-in. partitions	2.0	2.5
4-in. partitions	2.1	2.6
5-in. partitions	2.3	2.9
6-in. partitions	2.6	3.3
8-in. partitions	3.4	4.2
Columns and partitions	2.3	2.9
Book tile on flat roofs and ceilings	2.5	3.1
Pitched roofs	2.1	2.6

CHAPTER X

STRUCTURAL STEEL

Erection of Steel.—For wall-bearing jobs before the war the cost was sometimes as low as $6 per ton, and for riveted work in office buildings with labor rates and conditions as they were in 1912 to 1915, the price ran from $8 to $12 per ton. Under the same conditions, the cost of erection of trusses and girders was from $12 to $20, while train sheds and such structures frequently cost $25 per ton. At the present time due to the inefficiency and the cost of labor, the prices are just about double the figures given above.

The table "Cost of Structural Steel in Buildings" gives the actual cost of the steel work erected in place for 45 buildings which were put up in the vicinity of New York City between the years 1907 and 1922. While this table does not give the cost of the erection of steel by itself, it gives what is perhaps more useful, the entire cost in place, together with the average cost of structural steel shapes f.o.b. Pittsburgh for the same years. There is an apparent discrepancy between the base price of steel for the year 1920 as compared with the total cost. The rolling mills at this time were so far behind with their orders that while the price was as given, $59.80 f.o.b. cars, Pittsburgh, the actual price which one had to pay if quick delivery was wanted, would run anywhere from $75 to $100 per ton.

There are a number of features that enter into the cost of the erection of structural steel that should be taken into account in figuring the cost of any particular job. Some of these are as follows:

1. Location; whether the work is convenient to labor, supplies, etc.
2. Condition of the labor and material market at the time the work is to be done.
3. Weight of the heaviest pieces to be handled and the conditions under which they have to be transported and set.
4. The personality of the architect or engineer. This frequently seriously affects the cost of the work

5. A slight variation in the size and shape of the building sometimes makes an increase in the erection cost. It costs at the present time about $600 to set up and take down a derrick, engine, compressor, etc. to do a one derrick job. The ordinary derricks used today will handle a job about 100 by 100 ft. If one of the dimensions of the building is more than 100 ft., as for a building 80 by 120 ft., it would probably necessitate the use of two derricks which would practically

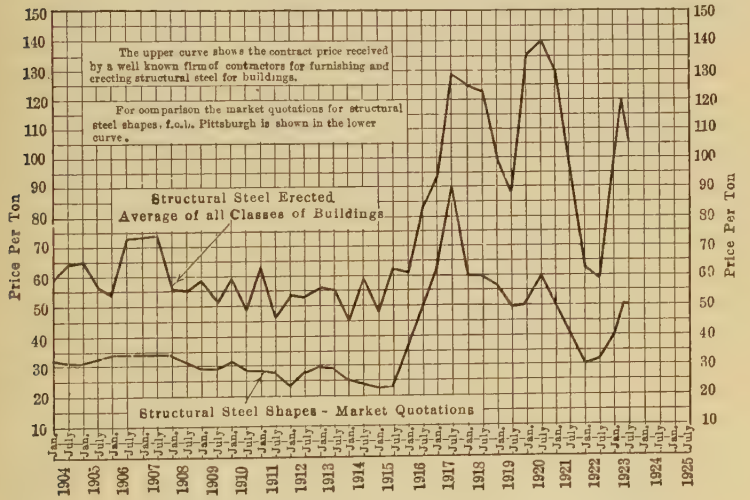


Fig. 1.

double the cost of the above item, and would make an appreciable variation in the cost per ton for erecting the steel.

6. The cost of erecting steel work in high buildings in New York City, as well as in some other cities, has been increased by the zoning laws requiring offsets at certain heights. This sometimes means that the derrick that is being used to erect the upper part of the building cannot reach the street, thus requiring an additional derrick at the offset level, with a second handling of all pieces that go into the upper part.

Cost of Structural Steel in Buildings

Date	Type of building	General dimensions, feet	Stories	Tons	Price per ton	Steel f.o.b. Pittsburgh, average price
1907	Office	209 by 185	36	13,182	$64.00	$34.00
1908	.....	250 by 200	16	8,558	56.00	30.00
1908	Apartment house	340 by 240	13	5,198	55.00	
1909	Office	221 by 70	13	3,907	59.00	28.00
1909	Office	191 by 60	13	2,914	59.00	
1909	Office	150 by 56	21	2,444	47.00	
1909	Warehouse	206 by 200	2	2,868	63.00	
1910	Hotel	245 by 100	26	4,099	55.00	29.20
1910	Bank	95 by 63	23	1,743	60.00	
1911	Office	138 by 96	21	3,459	50.00	26.40
1911	Loft	121 by 42	7	930	54.00	
1911	Office	100 by 86	24	3,595	56.00	
1911	Office	195 by 68	17	2,310	57.00	
1911	Office	118 by 86	14	1,186	56.00	
1911	Office	198 by 75	20	3,622	62.00	
1912	Office	144 by 100	22	4,968	46.00	26.00
1912	Office	99 by 78	27	2,868	51.00	
1912	Office	147 by 95	17	2,527	52.00	
1913	Office	206 by 102	34	12,969	53.00	28.40
1913	Office	185 by 80	21	2,413	53.00	
1913	Office	144 by 110	7	781	57.00	
1914	Loft	198 by 145	14	4,664	56.00	23.20
1914	Club	96 by 85	22	2,537	55.00	
1914	Office	254 by 100	21	4,646	45.00	
1914	Loft	100 by 63	13	2,031	46.00	
1915	Office	157 by 100	10	1,549	45.00	26.00
1915	Office	122 by 86	12	2,144	48.00	
1916	Office	93 by 70	21	1,949	63.00	50.00
1916	Office	90 by 50	32	2,546	76.00	
1916	Hotel	280 by 195	24	17,866	82.00	
1916	Office	189 by 167	..	2,931	81.00	
1917	Office	138 by 46	34	4,153	112.00	73.20
1917	Office	92 by 50	23	1,323	100.00	
1919	Office	150 by 140	6	1,526	95.00	50.60
1919	Office	248 by 200	23	12,570	88.00	
1920	Office	160 by 144	26	3,083	102.00	59.80
1920	Office	200 by 170	21	4,377	130.00	
1920	Office	240 by 100	24	5,310	135.00	
1920	Office	167 by 80	30	6,240	134.00	
1920	Office	188 by 113	23	3,108	131.00	
1921	Club	185 by 200	7	1,772	75.00	39.40
1921	Office	370 by 154	19	12,383	70 00	
1922	Office	116 by 90	24	3,250	60.00	34.00
1922	Loft	100 by 215	13	2,992	65.00	
1922	Office	198 by 125	27	5,712	60.00	

Weight of Steel per Cubic Foot in Office Buildings.—The actual weight of steel per cubic foot for 10 buildings which were erected 10 stories or over in height averaged 2.88 lb. Figures of this kind, however, will vary with the size of the building, and should not be used except for rough estimating.

Estimating.—In figuring the cost of structural steel it is necessary first to make an estimate of the material required for the job. With a set of steel plans it is not difficult to determine the amount of steel in the main members but it is usually left for the estimator to approximate such items as gusset plates, connection angles, rivets, bolts, tie rods, etc.

Standard Sizes.—Where the sizes of beams, channels, etc. are given without weights, it is customary to estimate the lightest standard section. For instance, if a 12-in. channel is specified, the weight would be assumed to be 20.7 lb. per lineal foot, or if a 12-in. beam is specified, no weight being given, the weight would be assumed to be 31.8 lb. per lineal foot. Sections lighter than the lightest standard are listed, but they are rarely used, are not kept in stock and only rolled to special order. Where an angle is given without thickness, it is fair to assume the light weight. As for instance a 6- by 4-in. angle is assumed to be $\frac{3}{8}$ in. thick and to weigh 12.3 lb. per lineal foot.

Weight of Details.—On such work as plate girders, columns, truss work, etc., the rivets amount to about 5 per cent, but if the shipping weight is wanted, only the heads of the rivet and bolt should be added. These do not add more than 2 per cent. For beam work the connecting angles can be easily estimated as they are usually known as standard connections, the weight of which is given in Table XIII or can be found in any steel millbook. For riveted truss work, the gussets, connection angles, etc. frequently run from 20 to 30 per cent of the weight of the main members. If, however, the steel plans are well drawn, these members can be scaled and estimated more accurately.

Many times the plans do not show such items as connection angles, bearing plates, separators, etc., although they are frequently called for in the specifications. Therefore, it is necessary for the estimator to include these items. All wall-bearing beams are supposed to have either cast-iron or steel-plate bearings and in most cases a government anchor. These bearing plates when not specified are usually

made of rolled steel plate and the ordinary size is given in Carnegie and other millbooks or can be found in Table I. For wall-bearing beams it is usual also to include an anchor bolt. Where beams connect to plate girders or other beams, the connection should be as shown on the plans, or if not shown, will be the standard connection angles as given in the millbooks. Where two or more beams are used for grillage or lintels, it is necessary to include standard separators as shown in Table VIII.

Listing of Steel Work Where Prices Are to Be Requested from Steel Companies.—The various kinds of steelwork that carry different extras should be listed separately. In listing beams, channels, etc. one should show whether the punching is single or double, that is, whether they are to be punched in both flange and web. It should also be noted whether they are to be coped.

Cost of Fabrication.—The price of fabrication has fluctuated so rapidly within the last two or three years that it is hardly safe to make assumptions, but perhaps the average price has been about as follows: For column work in office buildings, etc. $35 per ton; for plate girder work $30 per ton; and for beam work $20 per ton. These prices include the profit for the fabricator, but do not include freight and erection.

Cost of Haul.—The cost of hauling structural steel from cars to the job under ordinary circumstances and where the individual members are not too heavy to be handled without a derrick, usually runs from $2 to $3 per ton. This will fluctuate of course with the distance to be hauled, quality of the roads, size of the individual members, etc.

Testing and Laboratory Inspection.—Inspection is sometimes required at the mill only and at other times at both mill and shop. The average cost of mill inspection is 35 cts. per ton and the cost of shop inspection is 65 cts. per ton, or $1 per ton for the two.

The cost of field inspection varies with the size of the job and the rapidity of the erection. The most common way is to pay the salary of an inspector and his expenses. The usual price is $350 per month plus expenses, which includes railway fare to and from the job, and from $50 up per month for living expenses.

Painting.—Structural steel averages about 150 sq. ft. of exposed surface per ton for plate girders, 250 sq. ft. for beams and 300 sq. ft. for trusses. The priming or shop coat should consist of best quality red lead and linseed oil, in the proportion of 22.2 lb. of red lead paste

to 0.53 gal. of linseed oil. One gallon of paint will cover about 500 sq. ft. For a general average 200 sq. ft. per ton of steel, and 150 sq. ft. per hour should be figured to apply paint.

PAINT PER TON OF STEEL

	Surface, square feet	First or shop coat				First and second coats				Labor, hours
		Red lead paste, pounds	Linseed oil, gallons	Red lead dry, pounds	Linseed oil, gallons	Red lead paste, pounds	Linseed oil, gallons	Red lead dry, pounds	Linseed oil, gallons	
Plate girders	150	6.7	0.16	6.2	0.21	6.3	0.17	5.9	0.22	1.0
Beams	250	11.1	0.27	10.4	0.36	10.6	0.28	9.9	0.37	1.6
Trusses	300	13.3	0.32	12.5	0.43	12.7	0.33	11.8	0.44	2.0

A small amount of lampblack should be added to the second coat and slightly more to the third coat. This will enable the painter to see readily if any work has not been properly covered and will facilitate inspection.

Red lead paint, ready mixed, costs about $2.75 per gallon. It needs constant stirring while using.

Superior Graphite paint, by the Detroit Graphite Company costs $1.90 and Oxide paints $1.75 per gallon. These prices are for barrel lots, f.o.b. Detroit.

Tables.—The accompanying tables will assist the estimator in preparing his estimate of the various structural items, the weights of which are ordinarily not given on the plans, such as cast-iron columns, column bases, etc. These tables should also be of considerable assistance in figuring weights and approximate costs for heavy hardware.

Weight of Cast Iron.—Where castings are required of irregular shapes it is customary to figure the volume in cubic inches, which multiplied by 0.26 will give the weight in pounds. This is on the assumption that cast iron weighs 450 lb. per cubic foot.

Table I.—Weights of Flat Rolled Steel
(Pounds per lineal foot)

Width, inches	Thickness, inches																
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
1/4	0.053	0.106	0.159	0.213	0.27	0.32	0.37	0.43	0.48	0.53	0.58	0.64	0.69	0.74	0.80	0.85
1/2	0.106	0.213	0.319	0.425	0.53	0.64	0.74	0.85	0.96	1.06	1.17	1.28	1.38	1.49	1.59	1 70
3/4	0.159	0 319	0.478	0.638	0.80	0.96	1.12	1.28	1.43	1.59	1.75	1.91	2.07	2.23	2.39	2.55
1	0.213	0.425	0.638	0.850	1.06	1.28	1.49	1.70	1.91	2.13	2.34	2.55	2.76	2.98	3.19	3.40
1 1/4	0.266	0.531	0.797	1.063	1.33	1.59	1.86	2.13	2.39	2.66	2.92	3.19	3.45	3.72	3.98	4.25
1 1/2	0.319	0.638	0.956	1.275	1.59	1.91	2.23	2.55	2.87	3.19	3.51	3.83	4.14	4.46	4.78	5.10
1 3/4	0.372	0 744	1.116	1.488	1.86	2.23	2.60	2.98	3.35	3.72	4.09	4.46	4.83	5.21	5.58	5.95
2	0.425	0.850	1.275	1.700	2.13	2.55	2.98	3.40	3.83	4.25	4 68	5.10	5.53	5.95	6.38	6.80
2 1/4	0.478	0.956	1.434	1.913	2.39	2.87	3.35	3.83	4.30	4.78	5.26	5.74	6.22	6.69	7.17	7.65
2 1/2	0.531	1.063	1.594	2.125	2.66	3.19	3.72	4.25	4.78	5.31	5.84	6 38	6.91	7.44	7.97	8.50
2 3/4	0.584	1.169	1.753	2.338	2 92	3.51	4 09	4.68	5.26	5.84	6.43	7.01	7.60	8.18	8.77	9 35
3	0.638	1.275	1.913	2.550	3.19	3.83	4.46	5.10	5.74	6.38	7.01	7.65	8.29	8.93	9.56	10.20
3 1/4	0.691	1.381	2.072	2.763	3.45	4.14	4.83	5.53	6.22	6.91	7.60	8.29	8.98	9.67	10.36	11.05
3 1/2	0.744	1.488	2.231	2.975	3 72	4.46	5.21	5.95	6.69	7.44	8 18	8.93	9 67	10.41	11.16	11.90
3 3/4	0.797	1.594	2.391	3.188	3.98	4.78	5.58	6.38	7.17	7.97	8.77	9.56	10.36	11.16	11.95	12.75
4	0.850	1.700	2.550	3.400	4.25	5.10	5.95	6.80	7.65	8.50	9 35	10.20	11.05	11.90	12.75	13.60
4 1/4	0.903	1.806	2.709	3.613	4.52	5.42	6.32	7.23	8.13	9.03	9.93	10.84	11.74	12.64	13.55	14.45
4 1/2	0.956	1.913	2.869	3.825	4 78	5 74	6.69	7.65	8.61	9.56	10.52	11.48	12.43	13.39	14.34	15.30
4 3/4	1.009	2.019	3.028	4.038	5.05	6.06	7.07	8.08	9.08	10.09	11.10	12.11	13.12	14 13	15.14	16.15
5	1.063	2.125	3.188	4.250	5.31	6.38	7.44	8.50	9.56	10.63	11.69	12.75	13.81	14.88	15.94	17.00
5 1/4	1.116	2.231	3.347	4.463	5.58	6.69	7.81	8.93	10.04	11.16	12.27	13.39	14 50	15.62	16 73	17.85
5 1/2	1.169	2.338	3.506	4.675	5.84	7.01	8 18	9 35	10.52	11.69	12.86	14.03	15 19	16.36	17 53	18.70
5 3/4	1.222	2 444	3.666	4.888	6 11	7 33	8 55	9 78	11.00	12.22	13 44	14.66	15 88	17 11	18 33	19 55
6	1.275	2.550	3.826	5.100	6 38	7 65	8 93	10.20	11.48	12.75	14.03	15.30	16 58	17.85	19 13	20.40
6 1/4	1.328	2.656	3.984	5.313	6.64	7.97	9.30	10.63	11.95	13.28	14.61	15.94	17.27	18.59	19.92	21.25
6 1/2	1.381	2 763	4.144	5.525	6 91	8 29	9 67	11.05	12.43	13 81	15.19	16 58	17 96	19 34	20 72	22 10
6 3/4	1.434	2 869	4.303	5.738	7 17	8 61	10 04	11 48	12 91	14 34	15 78	17 21	18 65	20 08	21 52	22 95
7	1.488	2.975	4.463	5.950	7.44	8 93	10 41	11.90	13.39	14 88	16 36	17 85	19 34	20 83	22 31	23 80
7 1/4	1.541	3.081	4.622	6.163	7.70	9 24	10.78	12 33	13 87	15 41	16 95	18 49	20 03	21 57	23 11	24 65
7 1/2	1.594	3 188	4.781	6.375	7 97	9 56	11 16	12 75	14 34	15 94	17 53	19 13	20 72	22 31	23 91	25 50
7 3/4	1.647	3 294	4.941	6.588	8 23	9 88	11 53	13 18	14 82	16 47	18 12	19 76	21 41	23 06	24 70	26 35
8	1.700	3.400	5.100	6.800	8 50	10.20	11 90	13.60	15.30	17 00	18 70	20.40	22 10	23.80	25 50	27.20
8 1/4	1.753	3 506	5.259	7 013	8 77	10 52	12 27	14 03	15 78	17 53	19 28	21 04	22 79	24 54	26 30	28 05
8 1/2	1.806	3 613	5 419	7 225	9 03	10 84	12 64	14 45	16 26	18 06	19 87	21 68	23 48	25 29	27 09	28 90
8 3/4	1.859	3 719	5 578	7 438	9 30	11 16	13 02	14 88	16 73	18 59	20 45	22 31	24 17	26 03	27 89	29 75
9	1.913	3 825	5 738	7 650	9 56	11 48	13 39	15 30	17 21	19 13	21 04	22 95	24 86	26 78	28 69	30 60
9 1/4	1.966	3 931	5 897	7 863	9 83	11 79	13 76	15 73	17 69	19 66	21 62	23 59	25 55	27 52	29 48	31 45
9 1/2	2 019	4 038	6 056	8 075	10 09	12 11	14 13	16 15	18 17	20 19	22 21	24 23	26 24	28 26	30 28	32 30
9 3/4	2.072	4 144	6 216	8 288	10 36	12 43	14 50	16 58	18 65	20 72	22 79	24 86	26 93	29 01	31 08	33 15
10	2 125	4 250	6 375	8 500	10 63	12 75	14 88	17 00	19 13	21 25	23 38	25 50	27 63	29 75	31 88	34 00
10 1/4	2 178	4 356	6 534	8 713	10 89	13 07	15 25	17 43	19 60	21 78	23 96	26 14	28 32	30 49	32 67	34 85
10 1/2	2 231	4 463	6 694	8 925	11 16	13 39	15 62	17 8o	20 08	22 31	24 54	26 78	29 01	31 24	33 47	35 70
10 3/4	2 284	4 569	6 853	9 138	11 42	13 71	15 99	18 28	20 56	22 84	25 13	27 41	29 70	31 98	34 27	36 55
11	2 338	4 675	7 013	9 350	11 69	14 03	16 36	18 70	21 04	23 38	25 71	28 05	30 39	32 73	35 06	37 40
11 1/4	2 391	4 781	7 172	9 563	11 95	14 34	16 73	19 13	21 52	23 91	26 30	28 69	31 08	33 47	35 86	38 25
11 1/2	2 444	4 888	7 331	9 775	12 22	14 66	17 11	19 55	21 99	24 44	26 88	29 33	31 77	34 21	36 66	39 10
11 3/4	2 497	4 994	7 491	9 988	12 48	14 98	17 48	19 98	22 47	24 97	27 47	29 96	32 46	34 96	37 45	39 95
12	2 550	5 100	7 650	10 20	12 75	15 30	17 85	20 40	22 95	25 50	28 05	30 60	33 15	35 70	38 25	40 80

TABLE I.—WEIGHTS OF FLAT ROLLED STEEL.—(*Continued*)
(Pounds per lineal foot)

Width, inches	Thickness, inches															
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
12½	2.66	5.31	7.97	10.63	13.28	15.94	18.59	21.25	23.91	26.56	29.2	31.9	34.5	37.2	39.8	42.5
13	2.76	5.53	8.29	11.05	13.81	16.58	19.34	22.10	24.86	27.63	30.4	33.2	35.9	38.7	41.4	44.2
13½	2.87	5.74	8.61	11.48	14.34	17.21	20.08	22.95	25.82	28.69	31.6	34.4	37.3	40.2	43.0	45.9
14	2.98	5.95	8.93	11.90	14.88	17.85	20.83	23.80	26.78	29.75	32.7	35.7	38.7	41.7	44.6	47.6
14½	3.08	6.16	9.24	12.33	15.41	18.49	21.57	24.65	27.73	30.81	33.9	37.0	40.1	43.1	46.2	49.3
15	3.19	6.38	9.56	12.75	15.94	19.13	22.31	25.50	28.69	31.88	35.1	38.3	41.4	44.6	47.8	51.0
15½	3.29	6.59	9.88	13.18	16.47	19.76	23.06	26.35	29.64	32.94	36.2	39.5	42.8	46.1	49.4	52.7
16	3.40	6.80	10.20	13.60	17.00	20.40	23.80	27.20	30.60	34.00	37.4	40.8	44.2	47.6	51.0	54.4
16½	3.51	7.01	10.52	14.03	17.53	21.04	24.54	28.05	31.56	35 06	38.6	42.1	45.6	49.1	52.6	56.1
17	3.61	7.23	10.84	14 45	18.06	21.68	25 29	28.90	32.51	36 13	39.7	43.4	47.0	50.6	54.2	57.8
17½	3.72	7.44	11.16	14.88	18.59	22.31	26.03	29.75	33.47	37.19	40.9	44.6	48.3	52.1	55.8	59.5
18	3.83	7.65	11.48	15.30	19.13	22.95	26.78	30.60	34.43	38.25	42.1	45.9	49.7	53.6	57.4	61.2
18½	3.93	7.86	11.79	15.73	19.66	23.59	27.52	31.45	35.38	39.31	43.2	47.2	51.1	55.0	59 0	62.9
19	4.04	8.08	12.11	16.15	20.19	24 23	28 26	32.30	36.34	40.38	44.4	48.5	52.5	56.5	60 6	64.6
19½	4.14	8 29	12.43	16.58	20 72	24.86	29 01	33.15	37.29	41.44	45 6	49.7	53.9	58 0	62 2	66.3
20	4.25	8.50	12.75	17.00	21.25	25.50	29.75	34.00	38.25	42.50	46.8	51.0	55.3	59.5	63.8	68.0
20½	4.36	8.71	13.07	17.43	21 78	26 14	30.49	34.85	39.21	43.56	47.9	52.3	56.6	61.0	65.3	69.7
21	4.46	8.93	13.39	17.85	22.31	26 78	31.24	35.70	40 16	44.63	49.1	53.6	58 0	62 5	66.9	71.4
21½	4.57	9.14	13.71	18 28	22 84	27.41	31 98	36.55	41 12	45.69	50 3	54.8	59.4	64 0	68.5	73.1
22	4.68	9.35	14.03	18.70	23 38	28.05	32.73	37.40	42.08	46.75	51.4	56.1	60.8	65.5	70.1	74.8
22½	4.78	9.56	14.34	19.13	23.91	28.69	33.47	38 25	43.03	47.81	52.6	57.4	62.2	66 9	71 7	76.5
23	4.89	9.78	14.66	19.55	24 44	29.33	34.21	39.10	43.99	48.88	53.8	58.7	63.5	68 4	73 3	78.2
23½	4.99	9.99	14.98	19.98	24.97	29.96	34.96	39.95	44.94	49.94	54.9	59.9	64.9	69.9	74 9	79 9
24	5.10	10.20	15.30	20.40	25.50	30.60	35.70	40.80	45.90	51.00	56.1	61.2	66.3	71.4	76.5	81.6
25	5.31	10.63	15.94	21.25	26.56	31.88	37.19	42.50	47.81	53.13	58.4	63.8	69.1	74.4	79.7	85.0
26	5 53	11.05	16.58	22.10	27.63	33.15	38.68	44.20	49.73	55.25	60.8	66.3	71.8	77.4	82.9	88.4
27	5.74	11.48	17.21	22.95	28.69	34.43	40.16	45.90	51.64	57.38	63.1	68.9	74.6	80.3	86.1	91.8
28	5.95	11.90	17.85	23.80	29.75	35.70	41.65	47.60	53.55	59.50	65.5	71.4	77.4	83.3	89.3	95.2
29	6.16	12.33	18.49	24.65	30.81	36.98	43.14	49 30	55.46	61.63	67.8	74.0	80.1	86.3	92.4	98 6
30	6.38	12.75	19.13	25.50	31.88	38.25	44.63	51.00	57.38	63.75	70 1	76.5	82.9	89 3	95.6	102.0
31	6.59	13.18	19.76	26.35	32.94	39 53	46.11	52.70	59.29	65.88	72.5	79 1	85 6	92 2	98 8	105 4
32	6.80	13.60	20.40	27.20	34.00	40.80	47.60	54.40	61.20	68.00	74.8	81.6	88.4	95.2	102.0	108.8
33	7.01	14.03	21.04	28.05	35.06	42.08	49.09	56.10	63.11	70 13	77.1	84.2	91.2	98 2	105.2	112.2
34	7.23	14.45	21 68	28.90	36 13	43 35	50 58	57 80	65 03	72 25	79 5	86 7	93 9	101 2	108 4	115 6
35	7.44	14.88	22 31	29.75	37.19	44 63	52.06	59.50	66.94	74.38	81.8	89 3	96 7	104.1	111.6	119.0
36	7.65	15.30	22.95	30.60	38.25	45.90	53.55	61.20	68.85	76.50	84.2	91.8	99.5	107.1	114.8	122.4
37	7.86	15.73	23.59	31.45	39.31	47.18	55.04	62.90	70.76	78.63	86.5	94.4	102.2	110.1	117.9	125.8
38	8.08	16.15	24.23	32.30	40.38	48.45	56.53	64.60	72.68	80 75	88.8	96 9	105.0	113.1	121.1	129 2
39	8.29	16.58	24.86	33.15	41.44	49.73	58.01	66.30	74.59	82.88	91.2	99 5	107.7	116.0	124.3	132.6
40	8.50	17.00	25.50	34.00	42.50	51.00	59.50	68.00	76.50	85.00	93.5	102.0	110.5	119.0	127.5	136.0
41	8.71	17.43	26.14	34.85	43.56	52.28	60.99	69.70	78.41	87.13	95.8	104.6	113.3	122.0	130.7	139.4
42	8.93	17.85	26.78	35.70	44.63	53.55	62.48	71.40	80.33	89.25	98.2	107 1	116.0	125.0	133.9	142.8
43	9.14	18.28	27.41	36.55	45.69	54.83	63.96	73.10	82.24	91.38	100.5	109.7	118.8	127.9	137.1	146.2
44	9.35	18.70	28.05	37.40	46.75	56.10	65.45	74.80	84.15	93.50	102.9	112.2	121.6	130.9	140.3	149.6
45	9.56	19.13	28.69	38.25	47.81	57.38	66.94	76.50	86.06	95.63	105.2	114.8	124.3	133.9	143.4	153 0
46	9.78	19.55	29.33	39.10	48.88	58.65	68.43	78.20	87.98	97.75	107 5	117.3	127.1	136.9	146.6	156.4
47	9.99	19.98	29.96	39.95	49.94	59.93	69.91	79.90	89.89	99 88	109.9	119.9	129.8	139.8	149 8	159 8
48	10.20	20.40	30.60	40.80	51.00	61.20	71.40	81.60	91.80	102.0	112.2	122.4	132.6	142.8	153 0	163.2

TABLE I.—WEIGHTS OF FLAT ROLLED STEEL.—(*Concluded*)
(Pounds per lineal foot)

Width, inches	Thickness, inches																
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
49	10.4	20.8	31.2	41.7	52.1	62.5	72.9	83.3	93.7	104.1	114.5	125.0	135.4	145.8	156.2	166.6
50	10.6	21.3	31.9	42.5	53.1	63.8	74.4	85.0	95.6	106.3	116.9	127.5	138.1	148.8	159.4	170.0
51	10.8	21.7	32.5	43.4	54.2	65.0	75.9	86.7	97.5	108.4	119.2	130.1	140.9	151.7	162.6	173.4
52	11.1	22.1	33.2	44.2	55.3	66.3	77.4	88.4	99.5	110.5	121.6	132.6	143.7	154.7	165.8	176.8
53	11.3	22.5	33.8	45.1	56.3	67.6	78.8	90.1	101.4	112.6	123.9	135.2	146.4	157.7	168.9	180.2
54	11.5	23.0	34.4	45.9	57.4	68.9	80.3	91.8	103.3	114.8	126.2	137.7	149.2	160.7	172.1	183.6
55	11.7	23.4	35.1	46.8	58.4	70.1	81.8	93.5	105.2	116.9	128.6	140.3	151.9	163.6	175.3	187.0
56	11.9	23.8	35.7	47.6	59.5	71.4	83.3	95.2	107.1	119.0	130.9	142.8	154.7	166.6	178.5	190.4
57	12.1	24.2	36.3	48.5	60.6	72.7	84.8	96.9	109.0	121.1	133.2	145.4	157.5	169.6	181.7	193.8
58	12.3	24.7	37.0	49.3	61.6	74.0	86.3	98.6	110.9	123.3	135.6	147.9	160.2	172.6	184.9	197.2
59	12.5	25.1	37.6	50.2	62.7	75.2	87.8	100.3	112.8	125.4	137.9	150.5	163.0	175.5	188.1	200.6
60	12.8	25.5	38.3	51.0	63.8	76.5	89.3	102.0	114.8	127.5	140.3	153.0	165.8	178.5	191.3	204.0
61	13.0	25.9	38.9	51.9	64.8	77.8	90.7	103.7	116.7	129.6	142.6	155.6	168.5	181.5	194.4	207.4
62	13.2	26.4	39.5	52.7	65.9	79.1	92.2	105.4	118.6	131.8	144.9	158.1	171.3	184.5	197.6	210.8
63	13.4	26.8	40.2	53.6	66.9	80.3	93.7	107.1	120.6	133.9	147.3	160.7	174.0	187.4	200.8	214.2
64	13.6	27.2	40.8	54.4	68.0	81.6	95.2	108.8	122.4	136.0	149.6	163.2	176.8	190.4	204.0	217.6
65	13.8	27.6	41.4	55.3	69.1	82.9	96.7	110.5	124.3	138.1	151.9	165.8	179.6	193.4	207.2	221.0
66	14.0	28.1	42.1	56.1	70.1	84.2	98.2	112.2	126.2	140.3	154.3	168.3	182.3	196.4	210.4	224.4
67	14.2	28.5	42.7	57.0	71.2	85.4	99.7	113.9	128.1	142.4	156.6	170.9	185.1	199.3	213.6	227.8
68	14.5	28.9	43.4	57.8	72.3	86.7	101.2	115.6	130.1	144.5	159.0	173.4	187.9	202.3	216.8	231.2
69	14.7	29.3	44.0	58.7	73.3	88.0	102.6	117.3	132.0	146.6	161.3	176.0	190.6	205.3	219.9	234.6
70	14.9	29.8	44.6	59.5	74.4	89.3	104.1	119.0	133.9	148.8	163.6	178.5	193.4	208.3	223.1	238.0
71	15.1	30.2	45.3	60.4	75.4	90.5	105.6	120.7	135.8	150.9	166.0	181.1	196.1	211.2	226.3	241.4
72	15.3	30.6	45.9	61.2	76.5	91.8	107.1	122.4	137.7	153.0	168.3	183.6	198.9	214.2	229.5	244.8
73	15.5	31.0	46.5	62.1	77.6	93.1	108.6	124.1	139.6	155.1	170.6	186.2	201.7	217.2	232.7	248.2
74	15.7	31.5	47.2	62.9	78.6	94.4	110.1	125.8	141.5	157.3	173.0	188.7	204.4	220.2	235.9	251.6
75	15.9	31.9	47.8	63.8	79.7	95.6	111.6	127.5	143.4	159.4	175.3	191.3	207.2	223.1	239.1	255.0
76	16.2	32.3	48.5	64.6	80.8	96.9	113.1	129.2	145.4	161.5	177.7	193.8	210.0	226.1	242.3	258.4
77	16.4	32.7	49.1	65.5	81.8	98.2	114.5	130.9	147.3	163.6	180.0	196.4	212.7	229.1	245.4	261.8
78	16.6	33.2	49.7	66.3	82.9	99.5	116.0	132.6	149.2	165.8	182.3	198.9	215.5	232.1	248.6	265.2
79	16.8	33.6	50.4	67.2	83.9	100 7	117.5	134.3	151.1	167.9	184.7	201.5	218.2	235.0	251.8	268.6
80	17.0	34.0	51.0	68.0	85.0	102.0	119.0	136.0	153.0	170.0	187.0	204.0	221.0	238.0	255.0	272.0
81	17.2	34.4	51.6	68.9	86.1	103.3	120.5	137.7	154.9	172.1	189.3	206.6	223.8	241.0	258.2	275.4
82	17.4	34.9	52.3	69.7	87.1	104.6	122.0	139.4	156.8	174.3	191.7	209.1	226.5	244.0	261.4	278.8
83	17.6	35.3	52.9	70.6	88.2	105.8	123.5	141.1	158.7	176.4	194.0	211.7	229.3	246.9	264.6	282.2
84	17.9	35.7	53.6	71.4	89.3	107.1	125.0	142.8	160.7	178.5	196.4	214.2	232.1	249.9	267 8	285.6
85	18.1	36.1	54.2	72.3	90.3	108.4	126.4	144.5	162.6	180.6	198.7	216.8	234.8	252.9	270.9	289.0
86	18.3	36.6	54.8	73.1	91.4	109.7	127.9	146.2	164.5	182.8	201.0	219.3	237.6	255.9	274.1	292.4
87	18.5	37.0	55.5	74.0	92.4	110.9	129.4	147.9	166.4	184.9	203.4	221.9	240.3	258.8	277.3	295.8
88	18.7	37.4	56.1	74.8	93.5	112.2	130.9	149.6	168.3	187.0	205.7	224.4	243.1	261.8	280.5	299.2
89	18.9	37.8	56.7	75.7	94.6	113.5	132.4	151.3	170.2	189.1	208.0	227.0	245.9	264.8	283.7	302.6
90	19.1	38.3	57.4	76.5	95.6	114.8	133.9	153.0	172.1	191.3	210.4	229.5	248.6	267.8	286.9	306.0
91	19.3	38.7	58.0	77.4	96.7	116.0	135.4	154.7	174.0	193.4	212.7	232.1	251.4	270.7	290.1	309.4
92	19.6	39.1	58.7	78.2	97.8	117.3	136.9	156.4	176.0	195.5	215.1	234.6	254.2	273.7	293.3	312.8
93	19.8	39.5	59.3	79.1	98.8	118.6	138.3	158.1	177.9	197.6	217.4	237.2	256.9	276.7	296.4	316.2
94	20.0	40.0	59.9	79.9	99.9	119.9	139.8	159.8	179.8	199.8	219.7	239.7	259.7	279.7	299.6	319.6
95	20.2	40.4	60.6	80.8	100.9	121.1	141.3	161.5	181.7	201.9	222.1	242.3	262.4	282.6	302 8	323.0
96	20.4	40.8	61.2	81.6	102.0	122.4	142.8	163.2	183.6	204.0	224.4	244.8	265.2	285.6	306.0	326.4
97	20.6	41.2	61.8	82.5	103.1	123.7	144.3	164.9	185.5	206.1	226.7	247.4	268.0	288.6	309.2	329.8
98	20.8	41.7	62.5	83.3	104.1	125.0	145.8	166.6	187.4	208.3	229.1	249.9	270.7	291.6	312.4	333.2
99	21.0	42.1	63.1	84.2	105.2	126.2	147.3	168.3	189.3	210.4	231.4	252.5	273.5	294.5	315.6	336.6
100	21.3	42.5	63.8	85.0	106.3	127.5	148.8	170.0	191.3	212.5	233.8	255.0	276.3	297.5	318.8	340.0

Table II.—Weight of Carnegie Beams and Channels

Structural beams

Section index	Depth in inches	Weight per lineal foot				
B61	27	90.0	.....	.....	.....	.....
B24	24	105.0	110.0	115.0	.....	.....
B1	24	80.0	85.0	90.0	95.0	110.0
B62	24	74.0	.....	.....	.....	.....
B63	21	60.5	.....	.....	.....	.....
B2	20	80.0	85.0	90.0	95.0	100.0
B3	20	65.0	70.0	75.0	.....	.....
B81	18	75.0	80.0	85.0	90.0	.....
B80	18	55.0	60.0	65.0	70.0	.....
B5	15	60.0	65.0	70.0	75.0	.....
B7	15	42.0	45.0	50.0	55.0	.....
B65	15	37.5				
B8	12	40.0	45.0	50.0	55.0	
B9	12	31.5	35.0			
B66	12	28.0				
B11	10	25.0	30.0	35.0	40.0	
B67	10	22.5				
B13	9	21.0	25.0	30.0	35.0	
B15	8	18.0	20.5	23.0	25.5	
B68	8	17.5				
B17	7	15.0	17.5	20.0		
B19	6	12.25	14.75	17.75		
B21	5	9.75	12.25	14.75		
B23	4	7.5	8.5	9.5	10.5	
B77	3	5.5	6.5	7.5		

Structural channels

Section index	Depth in inches	Weight per lineal foot					
C1	15	33.0	35.0	40.0	45.0	50.0	55.0
C2	12	20.5	25.0	30.0	35.0	40.0	
C3	10	20.0	25.0	30.0	35.0		
C4	9	13.25	15.0	20.0	25.0		
C5	8	11.25	13.75	16.25	18.75	21.25	
C6	7	9.75	12.25	14.75	17.25	19.75	
C7	6	8.0	10.50	13.0	15.50		
C8	5	6.5	9.0	11.5			
C9	4	5.25	6.25	7.25			
C72	3	4.0	5.0	6.0			

H-Beams

Section index	Depth in inches	Width of flange	Weight per foot
H4	8	8	34.0
H3	6	6	23.8
H2	5	5	18.7
H1	4	4	13.6

TABLE III.—WEIGHTS OF STEEL ANGLES

Inches	1⅛	1 1/16	1	15/16	⅞	13/16	¾	11/16	⅝	9/16	½	7/16	⅜	5/16	¼	3/16	⅛
8 by 8	56.9	54.0	51.0	48.1	45.0	42.0	38.9	35.8	32.7	29.6	26.4						
8 by 6	....	...	44.2	41.7	39.1	36.5	33.8	31.2	28.5	25.7	23.0	20.2					
8 by 3½	....	....	35.7	33.7	31.7	29.6	27.5	25.3	23.2	21.0	18.7	16.5					
7 by 3½	....	....	32.3	30.5	28.7	26.8	24.9	23.0	21.0	19.1	17.0	15.0	13.0				
6 by 6	....	....	37.4	35.3	33.1	31.0	28.7	26.5	24.2	21.9	19.6	17.2	14.9				
6 by 4	....	....	30.6	28.9	27.2	25.4	23.6	21.8	20.0	18.1	16.2	14.3	12.3				
6 by 3½	....	....	28.9	27.3	25.7	24.0	22.4	20.6	18.9	17.1	15.3	13.5	11.7	9.8			
5 by 5	....	....	30.6	28.9	27.2	25.4	23.6	21.8	20.0	18.1	16.2	14.3	12.3				
5 by 4	....	....	....	....	24.2	22.7	21.1	19.5	17.8	16.2	14.5	12.8	11.0				
5 by 3½	....	....	....	....	22.7	21.3	19.8	18.3	16.8	15.2	13.6	12.0	10.4	8.7			
5 by 3	....	....	....	....	....	19.9	18.5	17.1	15.7	14.3	12.8	11.3	9.8	8.2			
4½ by 3	....	....	....	....	....	18.5	17.3	16.0	14.7	13.3	11.9	10.6	9.1	7.7			
4 by 4	....	....	....	....	....	19.9	18.5	17.1	15.7	14.3	12.8	11.3	9.8	8.2	6.6		
4 by 3½	....	....	....	....	....	18.5	17.3	16.0	14.7	13.3	11.9	10.6	9 1	7.7			
4 by 3	....	....	....	....	....	17.1	16.0	14.8	13.6	12.4	11.1	9.8	8.5	7.2	5 8		
3½ by 3½	....	....	....	....	....	17.1	16.0	14.8	13.6	12.4	11.1	9.8	8.5	7.2	5 8		
3½ by 3	....	....	....	....	....	15.8	14.7	13.6	12.5	11.4	10.2	9.1	7.9	6 6	5 4		
3½ by 2½	....	....	....	....	....	....	....	12.5	11.5	10.4	9.4	8.3	7.2	6.1	4 9		
3 by 3	....	....	....	....	....	....	....	....	11.5	10.4	9.4	8.3	7.2	6.1	4.9		
3 by 2½	....	....	....	....	....	....	....	....	....	9.5	8.5	7.6	6.6	5.6	4.5		
3 by 2	....	....	....	....	....	....	....	....	....	....	7.7	6.8	5.9	5.0	4.1		
2½ by 2½	....	....	....	....	....	....	....	....	....	....	7.7	6.8	5.9	5.0	4.1	3.07	2.08
2½ by 2	....	....	....	....	....	....	....	....	....	....	6.8	6.1	5.9	4 5	3 62	2 75	1.85
2½ by 1½	....	....	....	....	....	....	....	....	....	....	....	....	.....	3.92	3.19	2.44	
2¼ by 1½	....	....	....	....	....	....	....	....	....	....	5.6	5.0	4.4	3.66	2.98	2.28	
2 by 2	....	....	....	....	....	....	....	....	....	....	....	5.3	4.7	3.92	3.19	2.44	1.65
2 by 1½	....	....	....	....	....	....	....	....	....	....	....	....	3.99	3.39	2.77	2.12	1.44
2 by 1¼	....	....	....	....	....	....	....	....	....	....	....	....	.....	.....	2.55	1.66	
1¾ by 1¾	....	....	....	....	....	....	....	....	....	....	....	4.6	3.99	3.39	2.77	2.12	1.44
1¾ by 1¼	....	....	....	....	....	....	....	....	....	....	....	....	.....	.....	2.34	1.80	1.23
1½ by 1½	....	....	....	....	....	....	....	....	....	....	....	....	3.35	2.86	2.34	1.80	1.23
1½ by 1¼	....	....	....	....	....	....	....	....	....	....	....	....	.....	2.59	2.13	1.64	
1¼ by 1¼	....	....	....	....	....	....	....	....	....	....	....	....	.....	2.33	1.92	1.48	1.01
1 by 1	....	....	....	....	....	....	....	....	....	....	....	....	.....	.....	1.49	1 16	0.80

Table IV.—Square and Round Bars

Weights and areas

Size, inches	Weight, pound per foot		Area, square inches		Size, inches	Weight, pound per foot		Area, square inches	
	Square bars	Round bars	Square bars	Round bars		Square bars	Round bars	Square bars	Round bars
0	.....	.....	.....	.....	2	13.600	10.681	4.0000	3.1416
1/16	0.013	0.010	0.0039	0.0031	1/16	14.463	11.359	4.2539	3.3410
1/8	0.053	0.042	0.0156	0.0123	1/8	15.353	12.058	4.5156	3.5466
3/16	0.120	0.094	0.0352	0.0276	3/16	16.270	12.778	4.7852	3.7583
1/4	0.213	0.167	0.0625	0.0491	1/4	17.213	13.519	5.0625	3.9761
5/16	0.332	0.261	0.0977	0.0767	5/16	18.182	14.280	5.3477	4.2000
3/8	0.478	0.376	0.1406	0.1105	3/8	19.178	15.062	5.6406	4.4301
7/16	0.651	0.511	0.1914	0.1503	7/16	20.201	15.866	5.9414	4.6664
1/2	0.850	0.668	0.2500	0.1963	1/2	21.250	16.690	6.2500	4.9087
9/16	1.076	0.845	0.3164	0.2485	9/16	22.326	17.534	6.5664	5.1572
5/8	1.328	1.043	0.3906	0.3068	5/8	23.428	18.400	6.8906	5.4119
1 1/16	1.607	1.262	0.4727	0.3712	1 1/16	24.557	19.287	7.2227	5.6727
3/4	1.913	1.502	0.5625	0.4418	3/4	25.713	20.195	7.5625	5.9396
1 3/16	2.245	1.763	0.6602	0.5185	1 3/16	26.895	21.123	7.9102	6.2126
7/8	2.603	2.044	0.7656	0.6013	7/8	28.103	22.072	8.2656	6.4918
1 5/16	2.988	2.347	0.8789	0.6903	1 5/16	29.338	23.042	8.6289	6.7771
1	3.400	2.670	1.0000	0.7854	3	30.60	24.03	9.000	7.069
1/16	3.838	3.014	1.1289	0.8866	1/16	31.89	25.05	9 379	7.366
1/8	4.303	3.380	1.2656	0.9940	1/8	33.20	26.08	9.766	7.670
3/16	4.795	3.766	1.4102	1.1075	3/16	34.54	27.13	10.160	7.980
1/4	5.313	4.172	1.5625	1.2272	1/4	35.91	28.21	10.563	8.296
5/16	5.857	4.600	1.7227	1.3530	5/16	37.31	29.30	10.973	8.618
3/8	6.428	5.049	1.8906	1.4849	3/8	38.73	30.42	11.391	8.946
7/16	7.026	5.518	2.0664	1.6230	7/16	40.18	31.55	11.816	9.281
1/2	7.650	6.008	2.2500	1.7671	1/2	41.65	32.71	12.250	9.621
9/16	8.301	6.519	2.4414	1.9175	9/16	43.15	33.89	12.691	9.968
5/8	8.978	7.051	2.6406	2.0739	5/8	44.68	35.09	13.141	10.321
1 1/16	9.682	7.604	2.8477	2.2365	1 1/16	46.23	36.31	13.598	10.680
3/4	10.413	8.178	3.0625	2.4053	3/4	47.81	37.55	14.063	11.045
1 3/16	11.170	8.773	3.2852	2.5802	1 3/16	49.42	38.81	14.535	11.416
7/8	11.953	9.388	3.5156	2.7612	7/8	51.05	40.10	15.016	11.793
1 5/16	12.763	10.024	3.7539	2.9483	1 5/16	52.71	41.40	15.504	12.177

TABLE IV.—SQUARE AND ROUND BARS.—(*Continued*)

Size, inches	Weights and areas: Weight, pounds per foot		Area, square inches		Size, inches	Weight, pounds per foot		Area, square inches	
	Square bars	Round bars	Square bars	Round bars		Square bars	Round bars	Square bars	Round bars
4	54.40	42.73	16.000	12.566	6	122.40	96.13	36.000	28.274
1/16	56.11	44.07	16.504	12.962	1/16	124.96	98.15	36.754	28.866
1/8	57.85	45.44	17.016	13.364	1/8	127.55	100.18	37.516	29.465
3/16	59.62	46.83	17.535	13.772	3/16	130.17	102.23	38.285	30.069
1/4	61.41	48.23	18.063	14.186	1/4	132.81	104.31	39.063	30.680
5/16	63.23	49.66	18.598	14.607	5/16	135.48	106.41	39.848	31.296
3/8	65.08	51.11	19.141	15.033	3/8	138.18	108.53	40.641	31.919
7/16	66.95	52.58	19.691	15.466	7/16	140.90	110.66	41.441	32.548
1/2	68.85	54.07	20.250	15.904	1/2	143.65	112.82	42.250	33.183
9/16	70.78	55.59	20.816	16.349	9/16	146.43	115.00	43.066	33.824
5/8	72.73	57.12	21.391	16.800	5/8	149.23	117.20	43.891	34.472
11/16	74.71	58.67	21.973	17.257	11/16	152.06	119.43	44.723	35.125
3/4	76.71	60.25	22.563	17.721	3/4	154.91	121.67	45.563	35.785
13/16	78.74	61.85	23.160	18.190	13/16	157.79	123.93	46.410	36.450
7/8	80.80	63.46	23.766	18.665	7/8	160.70	126.22	47.266	37.122
15/16	82.89	65.10	24.379	19.147	15/16	163.64	128.52	48.129	37.800
5	85.00	66.76	25.000	19.635	7	166.60	130.85	49.000	38.485
1/16	87.14	68.44	25.629	20.129	1/16	169.59	133.19	49.879	39.175
1/8	89.30	70.14	26.266	20.629	1/8	172.60	135.56	50.766	39.871
3/16	91.49	71.86	26.910	21.135	3/16	175.64	137.95	51.660	40.574
1/4	93.71	73.60	27.563	21.648	1/4	178.71	140.36	52.563	41.282
5/16	95.96	75.36	28.223	22.166	5/16	181.81	142.79	53.473	41.997
3/8	98.23	77.15	28.891	22.691	3/8	184.93	145.24	54.391	42.718
7/16	100.53	78.95	29.566	23.221	7/16	188.07	147.71	55.316	43.445
1/2	102.85	80.78	30.250	23.758	1/2	191.25	150.21	56.250	44.179
9/16	105.20	82.62	30.941	24.301	9/16	194.45	152.72	57.191	44.918
5/8	107.58	84.49	31.641	24.850	5/8	197.68	155.26	58.141	45.664
11/16	109.98	86.38	32.348	25.406	11/16	200.93	157.81	59.098	46.415
3/4	112.41	88.29	33.063	25.967	3/4	204.21	160.39	60.063	47.173
13/16	114.87	90.22	33.785	26.535	13/16	207.52	162.99	61.035	47.937
7/8	117.35	92.17	34.516	27.109	7/8	210.85	165.60	62.016	48.707
15/16	119.86	94.14	35.254	27.688	15/16	214.21	168.24	63.004	49.483

TABLE IV.—SQUARE AND ROUND BARS.—(*Continued*)

Size, inches	Weight, pounds per foot		Area, square inches		Size, inches	Weight, pounds per foot		Area, square inches	
	Square bars	Round bars	Square bars	Round bars		Square bars	Round bars	Square bars	Round bars
	Weights and areas								
8	217.60	170.90	64.000	50.265	10	340.00	267.04	100.000	78.540
1/16	221.01	173.58	65.004	51.054	1/16	344.26	270.38	101.254	79.525
1/8	224.45	176.29	66.016	51.849	1/8	348.55	273.75	102.516	80.516
3/16	227.92	179.01	67.035	52.649	3/16	352.87	277.14	103.785	81.513
1/4	231.41	181.75	68.063	53.456	1/4	357.21	280.55	105.063	82.516
5/16	181.81	184.52	69.098	54.269	5/16	361.58	283.99	106.348	83.525
3/8	238.48	187.30	70.141	55.088	3/8	365.98	287.44	107.641	84.541
7/16	242.05	190.11	71.191	55.914	7/16	370 40	290.91	108.941	85.563
1/2	245.65	192.93	72.250	56.745	1/2	374.85	294.41	110.250	86.590
9/16	249.28	195.78	73.316	57.583	9/16	379 33	297.92	111.566	87.624
5/8	253.93	198.65	74.391	58.426	5/8	383.83	301.46	112.891	88.664
11/16	256.61	201.54	75.473	59.276	11/16	388.36	305.02	114.223	89.710
3/4	260.31	204.45	76.563	60.132	3/4	392.91	308.59	115.563	90.763
13/16	264.04	207.38	77.660	60.994	13/16	397.49	312.19	116.910	91.821
7/8	267.80	210.33	78.766	61.863	7/8	402.10	315.81	118.266	92.886
15/16	271.59	213.31	79.879	62.737	15/16	406.74	319.45	119.629	93.957
9	275.40	216.30	81.000	63.617	11	411.40	323.11	121.000	95.033
1/16	279.24	219.31	82.129	64.504	1/16	416.09	326.80	122.379	96.116
1/8	283.10	222.35	83.266	65.397	1/8	420.80	330.50	123.766	97.205
3/16	286.99	225.41	84.410	66.296	3/16	425.54	334.22	125.160	98.301
1/4	290.91	228.48	85.563	67.201	1/4	430.31	337.97	126.563	99.402
5/16	294.86	231.58	86.723	68.112	5/16	435.11	341.73	127.973	100.510
3/8	298.83	234.70	87.891	69.029	3/8	439.93	345.52	129.391	101.623
7/16	302.83	237.84	89.066	69.953	7/16	444.78	349.33	130.816	102.743
1/2	306.85	241.00	90.250	70.882	1/2	449.65	353.16	132.250	103.869
9/16	310.90	244.18	91.441	71.818	9/16	454.55	357.00	133.691	105.001
5/8	314.98	247.38	92.641	72.760	5/8	459.48	360.87	135.141	106.139
11/16	319.08	250.61	93.848	73.708	11/16	464.43	364.76	136.598	107.284
3/4	323.21	253.85	95.063	74.662	3/4	469.41	368.68	138.063	108.434
13/16	327.37	257.12	96.285	75.662	13/16	474.42	372.61	139.535	109.591
7/8	331.55	260.40	97.516	76.589	7/8	479.45	376.56	141.016	110.754
15/16	335.76	263.71	98.754	77.561	15/16	484.51	380.54	142.504	111.923
					12	489.60	384.53	144.000	113.098

TABLE V.—WEIGHTS OF CAST BASES FOR COLUMNS

Bearing in tons at 400 lb. per square inch	Size of bottom plate, feet	Thickness		Heights				
		Bottom plate, inches	Flangings, ribs and barrel, inches	1 ft. 0 in.	1 ft. 4 in.	1 ft. 8 in.	2 ft. 0 in.	2 ft. 6 in.
115	2 by 2	2	1½	650	775	900	1,000	1,200
		1¾	1¼	550	650	750	850	1,000
		1½	1	450	550	650	700	850
146	2¼ by 2¼	2	1½	700	900	1,000	1,150	1,350
		1¾	1¼	600	750	850	950	1,150
		1½	1	500	600	700	800	900
180	2½ by 2½	2	1½	800	1,000	1,150	1,300	1,500
		1¾	1¼	700	850	975	1,100	1,300
		1½	1	600	700	800	900	1,050
218	2¾ by 2¾	2	1½	900	1,100	1,300	1,450	1,650
		1¾	1¼	800	950	1,100	1,200	1,400
		1½	1	700	800	900	1,000	1,150
259	3 by 3	2	1½	1,100	1,275	1,425	1,575	1,800
		1¾	1¼	975	1,100	1,250	1,350	1,550
		1½	1	850	940	1,050	1,150	1,350
304	3¼ by 3¼	2	1½	1,250	1,400	1,550	1,700	1,950
		1¾	1¼	1,075	1,200	1,325	1,450	1,650
		1½	1	900	1,000	1,100	1,200	1,400
353	3½ by 3½	2	1½	1,400	1,575	1,725	1,875	2,125
		1¾	1¼	1,200	1,350	1,500	1,650	1,800
		1½	1	1,000	1,100	1,200	1,300	1,500
405	3¾ by 3¾	2	1½	1,550	1,750	1,900	2,050	2,300
		1¾	1¼	1,350	1,500	1,650	1,800	2,000
		1½	1	1,150	1,250	1,350	1,450	1,650
460	4 by 4	2	1½	1,700	1,950	2,100	2,300	2,550
		1¾	1¼	1,550	1,700	1,800	2,000	2,200
		1½	1	1,300	1,400	1,500	1,600	1,800
583	4½ by 4½	2	1½	2,100	2,300	2,500	2,700	3,000
		1¾	1¼	1,850	2,000	2,150	2,300	2,550
		1½	1	1,625	1,750	1,875	2,000	2,200

Table VI.—Round Cast-iron Columns
(Weight per foot of shaft only)

Exterior diameter	Thickness of shell													
	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1⅛ in.	1¼ in.	1⅜ in.	1½ in.	1⅝ in.	1¾ in.	1⅞ in.	2 in.	2⅛ in.
6	27.0	33.0	38.7	44.0										
7	....	39.1	46.0	52.6	58.9									
8	....	....	53.4	61.2	68.7	75.9								
9	....	....	....	69.8	78.5	87.0	95.1							
10	....	....	....	78.4	88.4	98.0	107.4	116.4						
11	....	....	....	....	98.2	109 1	119.7	129.9	139.9					
12	....	....	....	....	....	120.1	131.9	143.4	154.6	165.5				
13	....	....	....	....	....	131.2	144.2	156.9	169.4	181.5	193.3			
14	....	....	....	....	....	.....	156.5	170.4	184.1	197.4	210.5	223.2		
15	....	....	....	...	....	.....	.....	183.9	203.4	213.4	227.6	241.6	255.3	
16	....	....	....	....	....	.....	.....	.....	213.5	229.3	244.8	260.0	274.9	289.5

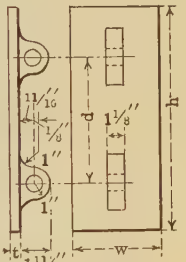
TABLE VII.—SQUARE CAST-IRON COLUMNS
(Weight per foot of shaft only)

Half distance around column, inches	Thickness of shell									
	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1⅛ in.	1¼ in.	1½ in.	1¾ in.	2 in.
10	28	34	40	45	50	55	59	66	71	75
12	34	42	49	56	63	69	74	84	93	100
14	41	50	59	67	75	83	90	103	115	125
16	47	58	68	78	88	97	106	122	137	150
18	53	65	77	89	100	111	121	141	159	175
20	59	73	87	100	113	125	137	159	180	200
22	66	81	96	111	125	139	152	178	202	225
24	72	89	105	122	138	153	168	197	224	250
26	78	97	115	133	150	167	184	216	246	275
28	84	104	124	143	163	181	199	234	268	300
30	91	112	134	154	175	195	215	253	290	325
32	97	120	143	165	188	209	230	272	312	350
34	103	128	152	176	200	223	246	291	344	375
36	109	136	162	187	213	237	262	310	365	400
38	116	144	171	198	225	251	277	328	387	425
40	122	151	180	209	238	265	293	347	399	450
42	128	159	190	220	250	279	309	366	421	475
44	134	167	199	231	263	294	324	384	443	500
46	140	175	209	243	275	308	340	403	465	525
48	147	183	218	254	288	322	356	422	487	550
50	153	190	227	264	300	336	371	441	509	575

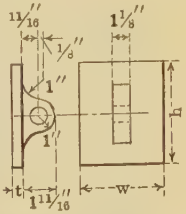
Add weight of flanges, brackets, etc. by multiplying volume in cubic inches by 0.26 lb.

Table VIII.—Beam Separators
(American Bridge Company Standard)

Beams				Separator						¾-in. bolts		Diagrams
				Dimensions								
Depth, inches	Weight per foot, pounds	Center to center of beams, inches	Out to out of flanges, inches	w in.	h in.	d in.	t in.	Weight, pounds	Increase in weight for 1 in. add. width	Length, inches	Weight, pounds hex. head and nut	Increase in weight for 1 in. add. length	
24	115–110–105	8¾	16¾	8	20	12	5/8	31	3.6	10½	3.4	0.25	
	100	8	15½	7¼	20	12	5/8	28	3.6	10	3.2	0.25	
24	95 and 90	8	15¼	7¼	20	12	5/8	28	3.6	10	3.2	0.25	
	85	8	15¼	7½	20	12	5/8	29	3.6	9½	3.1	0.25	
	80	8	15	7½	20	12	5/8	29	3.6	9½	3.1	0.25	
	100 and 95	8	15¼	7	16	12	5/8	22	2.9	10	3.2	0.25	
20	90	7½	14¾	6¾	16	12	5/8	22	2.9	9½	3.1	0.25	
	85 and 80	7½	14½	6¾	16	12	5/8	22	2.9	9	3.0	0.25	
	75	7½	14	6¾	16	12	5/8	22	2.9	9	3.0	0.25	
20	70	7	13½	6½	16	12	5/8	21	2.9	9	3.0	0.25	
	65	7	13¼	6½	16	12	5/8	21	2.9	8½	3.0	0.25	
	90	8	15¼	7	14	9	5/8	20	2.5	10	3.2	0.25	
18	85 and 80	8	15⅛	7¼	14	9	5/8	21	2.5	10	3.2	0.25	
	75	8	15	7½	14	9	5/8	21	2.5	10	3.2	0.25	
	70 and 65	7	13¼	6¼	14	9	5/8	18	2.5	9	3.0	0.25	
18	60	7	13¼	6½	14	9	5/8	19	2.5	8½	3.0	0.25	
	55	7	13	6½	14	9	5/8	19	2.5	8½	3.0	0.25	
	75	7	13¼	6	11	7½	½	12	1.6	9	3.0	0.25	
15	70 and 65	7	13¼	6¼	11	7½	½	12	1.6	9	3.0	0.25	
	60	6½	12½	5¾	11	7½	½	11	1.6	8	2.7	0.25	
	55	6½	12¼	5¾	11	7½	½	11	1.6	8	2.7	0.25	
15	50 and 45	6½	12¼	6	11	7½	½	12	1.6	8	2.7	0.25	
	42	6½	12	6	11	7½	½	12	1.6	8	2.7	0.25	
	55	6	11¾	5¼	8¾	5	½	9	1.3	8	2.7	0.25	
12	50	6	11½	5¼	8¾	5	½	9	1.3	8	2.7	0.25	
	45	6	11¼	5¼	8¾	5	½	9	1.3	7½	2.6	0.25	
12	40 and 35	6	11¼	5½	8¾	5	½	9	1.3	7½	2.6	0.25	
	31.5	6	11	5½	8¾	5	½	9	1.3	7½	2.6	0.25	
	40	5½	10¾	4¾	7½	..	½	6	1.1	7½	1.3	0.13	
	35	5½	10½	4¾	7½	..	½	6	1.1	7	1.3	0.13	
10	30	5½	10½	5	7½	..	½	7	1.1	7	1.3	0.13	
	25	5½	10	5	7½	..	½	7	1.1	7	1.3	0.13	
	35	5	10	4¼	6½	..	½	5	0.9	7	1.3	0.13	
9	30	5	9½	4¼	6½	..	½	5	0.9	6½	1.2	0.13	
	25	5	9½	4½	6½	..	½	5	0.9	6½	1.2	0.13	
	21	5	9¼	4½	6½	..	½	5	0.9	6½	1.2	0.13	
	25.5	4½	9	4	5½	..	½	4	0.8	6	1.1	0.13	
8	23	4½	8¾	4	5½	..	½	4	0.8	6	1.1	0.13	
	20.5 and 18	4½	8½	4	5½	..	½	4	0.8	6	1.1	0.13	
	20	4½	8½	4	5	..	½	4	0.7	6	1.1	0.13	
7	17.5	4½	8¼	4	5	..	½	4	0.7	6	1.1	0.13	
	15	4½	8¼	4¼	5	..	½	4	0.7	6	1.1	0.13	
	17.25	4	7¾	3½	4½	...	½	4	0.6	5½	1.1	0.13	
6	14.75	4	7½	3½	4½	..	½	4	0.6	5½	1.1	0.13	
	12.25	4	7½	3¾	4½	..	½	4	0.6	5½	1.1	0.13	



⅞-in. Cored Holes



⅞-in. Cored Hole

For 5-in., 4-in. and 3-in. beams, use 1-in. gas pipe 3¼ in., 3 in. and 2¾ in. long, respectively.

TABLE IX.—BOLTS WITH HEXAGON HEADS AND NUTS
American Bridge Company's standard
Weight in pounds per 100 bolts

Length under head, inches	Diameter of bolt, inches					Length under head, inches	Diameter of bolt, inches				
	½	⅝	¾	⅞	1		½	⅝	¾	⅞	1
1	19	33	52	...	...	8	58	92	137	194	264
1¼	20	34	54	....	....	8½	60	96	143	202	274
1½	22	36	57	....	....	9	63	100	149	210	285
1¾	23	38	60	....	....	9½	66	105	156	219	296
2	24	40	63	93	132	10	68	109	162	227	307
2¼	26	43	66	97	137	10½	71	114	168	236	318
2½	27	45	69	101	143	11	74	118	174	244	329
2¾	29	47	72	105	148	11½	77	122	181	253	341
3	30	49	75	109	154	12	80	127	187	261	352
3¼	31	51	78	114	160	12½	82	131	193	270	363
3½	33	54	82	118	165	13	85	135	199	278	374
3¾	34	56	85	122	171	13½	88	139	206	287	385
4	35	58	88	126	176	14	91	144	212	295	396
4¼	37	60	90	130	180	14½	93	148	218	304	407
4½	38	62	94	134	186	15	96	152	225	312	418
4¾	39	64	97	138	191	15½	99	157	231	321	430
5	41	66	100	143	197	16	102	161	237	329	441
5¼	42	68	103	147	202	16½	105	165	243	338	452
5½	44	71	106	151	208	17	107	170	250	346	463
5¾	45	73	109	156	213	17½	110	174	256	355	474
6	46	75	112	160	219	18	113	177	262	364	485
6¼	48	77	115	164	225	18½	116	183	268	372	496
6½	49	79	119	168	230	19	119	187	275	381	507
6¾	51	81	122	173	236	19½	121	191	281	389	519
7	52	84	125	177	241	20	124	196	287	398	530
7¼	53	86	128	181	247						
7½	55	88	131	185	252						
7¾	56	90	134	190	258						
Per inch additional	5.6	8.7	12.5	17.0	22.3	Per inch additional	5.6	8.7	12.5	17.0	22.3

TABLE X.—HEXAGON NUTS AND BOLT BEADS
American Bridge Company standard
(Weights in pounds for one head and one nut)

Diameter of bolt, inches	1¼	1½	1¾	2	2½	3
Hexagon head and nut.....	1.73	2.95	4.61	6.79	13.0	22.0
Weight of shank per inch...	0.3477	0.5007	0.6815	0.8900	1.391	2.003

TABLE XI.—BOLTS WITH SQUARE HEADS AND NUTS
American Bridge Company standard
(Weight in pounds per 100 bolts)

Length under head, inches	Diameter of bolt, inches								
	¼	5/16	⅜	7/16	½	⅝	¾	⅞	1
1	4	7	11	15	22	37	56		
1¼	4	7	11	16	23	39	59		
1½	5	8	12	17	24	41	62		
1¾	5	8	13	18	26	43	64		
2	5	9	14	19	27	45	67	101	144
2¼	6	9	15	20	28	47	71	104	150
2½	6	10	15	21	30	49	74	109	155
2¾	6	10	16	22	31	51	77	113	161
3	7	11	17	24	33	54	80	117	167
3½	7	12	18	25	35	58	86	126	178
4	8	13	20	28	38	62	92	134	189
4½	9	14	21	30	41	66	98	142	198
5	10	15	23	32	43	71	104	151	209
5½	10	16	25	34	46	75	111	159	220
6	11	17	26	36	49	79	117	168	232
6½	..	..	28	38	52	84	123	176	243
7	..	..	29	40	55	88	129	185	254
7½	..	..	31	42	57	92	136	193	265
8	..	..	32	45	60	97	142	202	276
9	..	..	34	49	65	105	154	218	298
10	..	..	..	53	71	114	167	235	320
12	..	..	..	61	82	131	192	269	364
14	..	..	..	..	93	148	217	303	409
Per inch additional.....	1.4	2.2	3.1	4.3	5.6	8.7	12.5	17.0	22.3

TABLE XII.—SQUARE NUTS AND BOLT HEADS
American Bridge Company standard
(Weights in pounds for one head and one nut)

Diameter of bolt, inches	1¼	1½	1¾	2	2½	3
Square head and nut.....	2.05	3.51	5.48	8.08	15.5	26.2
Weight of shank per inch...	0.3477	0.5007	0.6815	0.8900	1.391	2.003

TABLE XIII.—STANDARD BEAM CONNECTIONS
(Carnegie)

Beams, inches	Connection angles, inches	Weight, pounds
3 & 4	2–6 by 4 by ⅜–2	5
5–6–7	2–6 by 4 by ⅜–3	7
8–9–10	2–6 by 4 by ⅜–5½	13
12	2–4 by 4 by 7/16–8½	17
15–18–20	2–4 by 4 by 7/16–11½	23
21	2–4 by 4 by ½–1 ft.–2½	33
24	2–4 by 4 by ½–1 ft.–5½	39
27	2–4 by 4 by ½–1 ft.–8½	46

Rivets and bolts ¾-in. diameter.
Weights given are for shop rivets and angle connections.
About 20 per cent should be added for field rivets or bolts.

Price of Structural Steel.—The price of structural steel fluctuates so much that the current prices should always be secured before figuring any considerable quantity. The prices are usually given f.o.b. cars Pittsburgh to which the freight rate is to be added. The prices for September, 1923, for standard sizes were as follows:

Structural Material.—The following are base prices f.o.b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at the places given.

TABLE XIV

	Pittsburgh mill	Birmingham mill	New York	Dallas	Warehouse		San Francisco
					St. Louis	Chicago	
Beams, 3 to 15 in.	$2.50	$2.75	$3.64	$4.20	$3.45	$3.40	$3.60
Channels, 3 to 15 in.	2.50	2.75	3.64	4.20	3.45	3.40	3.60
Angles, 3 to 16 in., ¼ in. thick.	2.50	2.75	3.64	4.20	3.45	3.40	3.60
Tees, 3 in. and larger	2.50	2.75	3.64	4.20	3.50	3.40	3.60
Plates, ¼ in. thick and heavier	2.50	2.75	3.64	4.30	3.45	3.40	3.60

Rivets.—The following quotations are per 100 lb.:

TABLE XV.—STRUCTURAL

	Pittsburgh mill	New York		Warehouse		San Francisco	Dallas
		Sept. 6	One year ago	Chicago	St. Louis		
¾ in. and larger	$3.00@3.25	$4.40	$3.85	$3.75	$4.15	$5.00	$4 90

CONE HEAD BOILER

¼ in. and larger	$3.10@3.35	$4.50	$3.95	$3.85	$4.25	$5.10	$5 00
5/16 and 11/16	3.25@3.50	4.66	4.11	4.00	4.40	5.25	5.15
½ and 9/16	3.50@3.75	4 90	4 35	4.25	4 60	5 50	5 40

Lengths shorter than 1 in. take an extra of 50 cts. Lengths between 1 in. and 2 in. take an extra of 25 cts.

TABLE XVI

Nails.—The following quotations are per keg from warehouse:

	Pittsburgh mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$3.00	$3.45	$4.25	$4.25	$3.34	$4.95
Cut	.....	5.50	5.80	5.75	3.74	5.00

TABLE XVII

Ship Spikes.—Current prices per 100 lb.:

	San Francisco		Seattle
Inches	Galvanized	Black	Black
¼	$9.85	$7.65	$8.00
⅜	7.80	6.30	7.75
½	7.75	6.15	7.70

Pittsburgh base in lots of 200 kegs or more, $3.50.

TABLE XVIII

Sheets.—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue annealed	Pittsburgh large mill lots	St. Louis	Chicago	San Francisco	New York
No. 10	$3.00	$4.45	$4.15	$5.25	$4.59
No. 12	3.10	4.50	4.20	5.30	4.64
No. 14	3.20	4.55	4.25	5.35	4.69
No. 16	3.40	4.65	4.35	5.40	4.79
Black					
Nos. 18 and 20[1]	3.70	5.00	5.05	5.60	4.80
Nos. 22 and 24[1]	3.75	5.05	5.05	5.65	4.85
Nos. 26[1]	3.80	5.10	5.10	5.70	4.90
Nos. 28[1]	3.85	5.20	5.20	5.80	5.00
Galvanized					
No. 10	4.00	5.35	5.35	5.50	5.00
No. 12	4.10	5.45	5.45	5.60	5.10
No. 14	4.10	5.45	5.45	5.75	5.10
Nos. 17 to 21	4.40	5.75	5.74	5.90	5.40
Nos. 22 and 24	4.55	5.90	5.90	6.05	5.55
Nos. 25 and 26[1]	4.70	6.05	6.05	6.20	5.70
No. 28[1]	5.00	6.35	6.35	6.50	6.00

[1] For painted corrugated sheets 30 cts. is added per 1,000 lb. for 25 to 28 gage; 25 cts. for 19 to 24 gages; for galvanized corrugated sheets 15 cts. is added to all gages.

Freight Rates.—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.31	Detroit	$0.29
Birmingham	0.69	Kansas City	0.735
Boston	0.365	New Orleans	0.515
Buffalo	0.265	New York	0.34
Chicago	0.34	Pacific Coast (all rail)	1.34[2]
Cincinnati	0.29	Philadelphia	0.32
Cleveland	0.215	St. Louis	0.43
Denver	1.27[1]	St. Paul	0.60

[1] Minimum carload, 40,000 lb.

[2] Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.

For small sizes, irregular cutting, etc., there are certain additions to be made. They are known as the standard classification of extras, and are as follows:

EXTRAS IN CENTS PER POUND TO BE ADDED TO BASE PRICE (PER POUND) OF SHAPES

Size	
Standard structural beams and channels, 3 to 15 in., inclusive	Base
Angles—structural sizes—3 to 6 in. on one or both legs—¼ in. and over	Base
Zees—Structural sizes	Base
Standard structural beams—over 15 in	$0.10
Angles—structural sizes—over 6 in. on one or both legs	0.10
Tees—Structural sizes—3 to 6 in. on one or both legs—¼ in. thick and over—(excepting elevator, hand rail, car truck, and conductor rail tees)	0.05
Bulb beams	0.30
Bulb angles (not including the special bulb angles for torpedo boat destroyers, B 145, B 146, B 147)	0.30
Bulb angles—special—B 145, B 146, B 147	0.50

Other special sections, including supplementary beams and H-beams, should be submitted for prices.

Specification

Hull material subject to U. S. Navy Department Specifications for medium or soft steel $0.10
High-tensile Hull steel subject to U. S. Navy Department or equivalent specifications 1.00

Inspection

Mill inspection ..... No extra
Charges for such inspection as Lloyd's or American Bureau of Shipping, for buyer's account.

Cutting

Cutting to lengths under 3 to 2 ft., inclusive $0.25
Cutting to lengths under 2 to 1 ft., inclusive 0.50
Cutting to lengths under 1 ft 1.55
Cold sawing to exact length (within $\frac{1}{8}$ in.) 0.25
(subject to special arrangement)
No charge for cutting to lengths 3 ft. or over, subject to the following tolerances:

	Over	Under
Beams and channels	$\frac{3}{8}$ in.	$\frac{3}{8}$ in.
Angles, tees, zees and other shapes—structural sizes ...	$\frac{3}{4}$ in.	0 in.

FLATS

Width in inches	Thickness in inches						
	4 to 3 1/16	3 to 2 1/16	2 to 1 1/16	1 to 1 3/16	3/4 to 1/2	7/16 to 3/8	5/16 to 1/4
3/8	....	....	....	....	....	....	1.40
7/16	....	....	....	....	....	1.00	1.20
1/2	....	....	....	....	....	0.70	0.90
9/16	....	....	....	....	0.50	0.50	0.75
5/8 to 1 1/16	....	....	....	....	0.40	0.40	0.60
3/4 to 1 3/16	....	....	....	....	0.30	0.30	0.40
7/8 to 1 5/16	....	....	....	....	0.20	0.20	0.30
1 to 1 3/8	....	....	0.10	Base	Base	Base	0.15
1 7/16 to 2	....	....	0.10	Base	Base	Base	0.15
2 1/16 to 2 1/2	....	0.20	0.10	Base	Base	Base	0.15
2 9/16 to 3	....	0.20	0.10	Base	Base	Base	0.15
3 1/16 to 3 1/2	0.30	0.20	0.10	Base	Base	Base	0.15
3 9/16 to 4	0.30	0.20	0.10	Base	Base	Base	0.15
4 1/16 to 5	0.30	0.20	0.10	Base	Base	Base	0.15
5 1/16 to 6	0.30	0.20	0.10	Base	Base	Base	0.15

ROUNDS AND SQUARES

3/4 to 3 1/16	in	Base
5/8 to 1 1/16	in	$0.10
9/16	in	0.15
1/2	in	0.20
7/16	in	0.30
3/8	in	0.40
11/32	in	0.55
5/16	in	0.70
9/32	in	0.85
1/4	in	1.00

15/64	in	1.25
7/32	in	1.50
3/16	in	2.00
3 1/8 to 3 9/16	in	0.10
3 5/8 to 4 1/16	in	0.15
4 1/8 to 4 9/16	in	0.25
4 5/8 to 5 1/16	in	0.35
5 1/8 to 5 9/16	in	0.45
5 5/8 to 6 1/16	in	0.55
6 1/8 to 6 9/16	in	0.65
6 5/8 to 7 1/4	in	0.75

Hexagons

3/4 to 3 1/16	in	0.25
5/8 to 1 1/16	in	0.40
1/2 to 9/16	in	0.60
7/16	in	0.80
3/8	in	1.00
5/16	in	1.20
1/4	in	1.50

Equal Leg Angles

1 1/2 by 1 1/2	in. and wider, but under 3 in. by 3/16 in. and over	$0.15
1 1/2 by 1 1/2	in. and wider, but under 3 in. by 1/8 in	0.25
1 by 1 to 1 1/4 by 1 1/4	in. by 3/16 in. and over	0.25
1 by 1 to 1 1/4 by 1 1/4	in. by 1/8 in	0.30
7/8 by 7/8	in. by 3/16 in	0.35
7/8 by 7/8	in. by 1/8 in	0.40
3/4 by 3/4	in. by 3/16 in	0.45
3/4 by 3/4	in. by 1/8 in	0.60
5/8 by 5/8	in. by 1/8 in	1.50
5/8 by 5/8	in. by 3/32 in	2.00
1/2 by 1/2	in. by 1/8 in	2.20
1/2 by 1/2	in. by less than 1/8 in	2.50
3 by 3	in. by 3/16 in	0.35
3 by 3	in. by 1/8 in	0.50

Unequal Leg Angles

3 by 2 1/2 and 3 by 2	by less than 1/4	in. thick	0.35
1 by 5/8	by 3/16	in. thick	0.50
1 by 5/8	by 1/8	in. thick	0.60

Other unequal leg angles subject to special prices which will be furnished on application.

Channels

1½ in. and wider, but under 3 in. by 3/16 in. and over	$0.25
1½ in. and wider, but under 3 in. by ⅛ in	0.40
1 to 1¼ in. by 3/16 in. and over	0.40
1 to 1¼ in. by ⅛ in	0.50
1 to 1¼ in. by 7/64 in	0.70
¾ and ⅞ in. by 3/16 in. and over	0.50
¾ and ⅞ in. by ⅛ in	0.60
¾ and ⅞ in. by 7/64 in	0.80
⅝ in. by ⅛ in. and over	1.70
⅝ in. by 3/32 in	2.00
½ in. by 7/64 in. and over	2.50
½ in. by 5/64 in	3.00

Tees

1½ by 1½ in. and wider, but under 3 in., by 3/16 in. and over	0.30
1 by 1 to 1¼ by 1¼ in. by 3/16 in. and over	0.55
1 by 1 to 1¼ by 1¼ in. by ⅛ in	0.70
⅞ by ⅞ in. by 3/16 in	0.70
⅞ by ⅞ in. by ⅛ in	0.90
¾ by ¾ in. by 3/16 in	0.90
¾ by ¾ in. by ⅛ in	1.10
⅝ by ⅝ in. by ⅛ in	1.80
½ by ½ in. by ⅛ in	2.50

Unequal tees are subject to special prices which will be furnished on application.

Half Rounds—Solid

1 to 3 in	0.30
¾ to 15/16 in	0.50
⅝ to 11/16 in	0.70
½ to 9/16 in	1.00
⅜ to 7/16 in	1.50

Hollow half rounds are subject to special prices which will be furnished on application.

Half Ovals

1 to 4 in. by ¼ in. and over	$0.40
1 to 4 in. by Nos. 7, 8, 9 and 3/16 in	0.50
1 to 4 in. by Nos. 10, 11, 12 and ⅛ in	0.70
¾ to 15/16 in. by 3/16 in. and over	0.70
¾ to 15/16 in. by Nos. 10, 11, 12 and ⅛ in	0.90
¾ to 15/16 in. by Nos. 13, 14 and 15	1.20
⅝ to 11/16 in. by 5/32 in. and over	0.90

5/8 to 1 1/16 in. by Nos. 10, 11, 12 and 1/8 in.	1.20
5/8 to 1 1/16 in. by Nos. 13, 14 and 15	1.40
1/2 to 9/16 in. by 1/8 in. and over	1.20
1/2 to 9/16 in. by Nos. 13, 14 and 15	1.60
3/8 to 7/16 in. by 3/32 in. and over	2.00
3/8 to 7/16 in. by Nos. 14 and 15	2.40

OVALS

3/4 to 2 1/2 in. by 3/8 in. and over	0.30
3/4 to 2 1/2 in. by 1/4 in. to 5/16 in	0.40
3/4 to 2 1/2 in. by 5/32 in. to 3/16 in	0.70
5/8 to 1 1/16 in. by 5/16 in. and over	0.50
5/8 to 1 1/16 in. by 3/16 in. to 1/4 in	0.70
5/8 to 1 1/16 in. by 1/8 in. to 5/32 in	1.00
1/2 to 9/16 in. by 1/4 in. and over	1.00
1/2 to 9/16 in. by 1/8 in. to 3/16 in	1.30
1/2 to 9/16 in. by 3/32 in	1.60
3/8 to 7/16 in. by 3/16 in. and over	1.60
3/8 to 7/16 in. by 1/8 in. to 5/32 in	2.00
3/8 to 7/16 in. by 3/32 in	2.40

MACHINE-CUTTING TO SPECIFIED LENGTHS

Rounds and squares 1 1/2 in. and larger

(See also differentials for quantity cutting)

Machine-cutting to lengths over 48 in.	$0.20
Machine-cutting to lengths over 24 to 48 in., inclusive	0.30
Machine-cutting to lengths over 12 to 24 in., inclusive	0.40
Machine-cutting to lengths of 12 in. and less, extra will be furnished on application, but will not be less than	0.70

The above extras apply only to 0.50 per cent carbon and under. Extras for machine-cutting over 0.50 per cent carbon to be furnished on application.

Extras for machine-cutting rounds and squares under 1 1/2 in., flats, etc., will be furnished on application.

CUTTING TO SPECIFIED LENGTHS

Other than machine-cutting

(See also differentials for quantity cutting)

Cutting to lengths of 120 in. and over	No charge
Cutting to lengths over 60 in. to, but not including, 120 in.	$0.05
Cutting to lengths over 48 to 60 in., inclusive	0.10
Cutting to lengths over 24 to 48 in., inclusive	0.15
Cutting to lengths over 12 to 24 in., inclusive	0.30
Cutting to lengths of 12 in. and less, extra will be furnished on application, but will not be less than	0.40

Straightening

Extras for machine straightening will be furnished on application.

Quantity Differentials

(See also differentials for quantity cutting)

All specifications for less than 2,000 lb. of a size will be subject to the following extras, the total weight of a size ordered to determine the extra, regardless of length and regardless of exact quantity actually shipped.

Quantities less than 2,000 lb. but not less than 1,000 lb	$0.20
Quantities less than 1,000 lb	0.50

Differentials for Quantity Cutting

Whether or not quantity differentials or cutting extras apply there will be an extra charge for cutting less than 2,000 lb. of any size to a specific length, regardless of the total tonnage of the size ordered, regardless of what the length may be and regardless of exact quantity shipped, as follows:

Less than 2,000 lb. to 1,500 lb	$0.10
Less than 1,500 lb. to 1,000 lb	0.20
Less than 1,000 lb. to 500 lb	0.40
Less than 500 lb	0.60

Notes

For intermediate sizes, the next higher extra to be charged in all cases.

All extras are given in cents per pound.

Extras

To be added to base price (per pound) of plates.

Conditions

1. Rectangular plates, tank steel or conforming to Manufacturers' Standard Specifications for Structural Steel, dated September 1, 1916, or equivalent, ¼ in. thick and over on thinnest edge, 100 in. wide and under down to but not including 6 in. wide, are base.

2. Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per square foot, are considered ¼-in. plates. Plates over 72 in. wide must be ordered ¼ in. thick on edge, or not less than 11 lb. per square foot, to take base price.

3. Plates over 72 in. wide ordered less than 11 lb. per square foot down to the weight of $\frac{3}{16}$-in., take the price of $\frac{3}{16}$-in. plates, and all extras for width of $\frac{3}{16}$-in. plates, as well as gage.

4. Plates over 72 in. wide ordered to the weight of $\frac{3}{16}$-in. plate take extra of 15 per cent of base price plus proper extra for width.

5. Allowable overweight, whether plates are ordered to gage or weight, to be governed by the Standard Specifications of the Association of American Steel Manufacturers.

Gages

Gages lighter than ¼ in. to and including 3/16 in. on thin edge up to 72 in. wide inclusive, 10 per cent of Base Price.

Plates over 72 in. wide, ordered to weight of 3/16-in. plate, 15 per cent of base price plus proper extra for width.

Width

(Applies to plates ¼ in. thick and heavier)

Widths over 100 to and including 110 in.	$0.05
Widths over 110 to and including 115 in.	0.10
Widths over 115 to and including 120 in.	0.15
Widths over 120 to and including 125 in.	0.25
Widths over 125 to and including 130 in.	0.50

(Additional extras for wide light plates)

Gage on Thin Edge	Over 72 In. to 84 In. Wide, Inc.	Over 84 In. to 96 In. Wide, Inc.	Over 96 In. to 100 In. Wide, Inc.	Over 100 In. Wide
Under ¼ in.	0.10 ct.	0.20 ct.	0.30 ct.	0.35 ct.

Qualities

Pressing steel	$0.10
Flange steel (boiler grade)	0.15
Ordinary firebox steel	0.20
Stillbottom steel	0.30
Locomotive firebox steel	0.50
Marine steel	1.50
Hull material subject to U. S. Navy Dept. Specifications for medium or soft steel	0.10
High-tensile hull steel subject to U. S. Navy Dept., or equivalent specifications	1.00
Boiler steel subject to U. S. Navy Dept., specifications, Classes A and B	1.50

Hull plates to Hull specifications, required to stand cold-flanging, take extra for flange steel.

Floor Plates

Checkered plates	$1.75

Checkered plates are not furnished to sketch.

NOTE.—The "rectangular plate price" at which the difference is to be invoiced, is held to be the net price f.o.b. mill, which the maker would have realized had the rectangle been shipped to the same destination as the sketch cut from it. Such price is properly figured by adding to the Pittsburgh base price the full extras for size, gage, quality and cutting to length, and the carload freight rate from Pittsburgh to destination; and then deducting the carload freight rate from maker's mill to destination.

CIRCLES

Diameters 3 ft. 0 in. and over.....25 per cent of base price
Half circles take circle extras.
Sketches sheared to a radius take circle extras.

SPECIAL

Sketches or circles over 100 in. in width or diameter take width extras in addition to sketch or circle extras.

All sketches, regular, irregular, circular, semi-circular or special, with greatest dimension under 3 ft. 0 in., take length extras shown under rectangular plates, in addition to sketch or circle extras.

Sketches cannot be sheared with re-entrant angles.

COLD SAWING

For cold sawing items that cannot be sheared (such as stem bars), extra will be quoted on application.

INSPECTION

Mill inspection.....No extra
Charges for such inspection as Lloyd's or American Bureau of Shipping, for buyer's account.

CUTTING

(Rectangular plates)

Lengths 3 ft. 0 in. and over	No extra
Lengths under 3 ft. 0 in. to 2 ft. 0 in., inclusive	$0.25
Lengths under 2 ft. 0 in. to 1 ft. 0 in., inclusive	0.50
Lengths under 1 ft. 0 in	1.55

REGULAR SKETCHES

With not more than four straight cuts (including straight taper plates)
Lengths 3 ft. 0 in. and over..... $0.10

IRREGULAR SKETCHES

(With more than four straight cuts)

Lengths 3 ft. 0 in. and over..... $0.20

All sketch plates (other than those sheared to a radius) will be invoiced at actual weight of the sketch, at the base price, plus standard card extras (including sketch extras mentioned above), with an additional charge for waste, if any, to be determined by deducting the actual weight of each sketch from the estimated table weight of the smallest rectangular plate from which the said sketch can be secured, the difference to be invoiced at the rectangular plate price, less an allowance for the value as scrap, which allowance shall be 40 per cent of the base price of rectangular plate.[1]

STANDARD SPECIFICATION FOR STRUCTURAL STEEL FOR BUILDINGS

(As adopted by the American Institute of Steel Construction)

1. This Specification defines the practice adopted by the American Institute of Steel Construction for the design, fabrication, and erection of structural steel for buildings.

2. General.—To obtain a satisfactory structure, the following major requirements must be fulfilled.

(*a*) The material used must be suitable, of uniform quality, and without defects affecting the strength or service of the structure.

(*b*) Proper loads and conditions must be assumed in the design.

(*c*) The unit stresses must be suitable for the material used.

(*d*) The workmanship must be good, so that defects or injuries are not produced in the manufacture.

(*e*) The computations and design must be properly made so that the unit stresses specified shall not be exceeded, and the structure and its details shall possess the requisite strength and rigidity.

3. Material.—Structural steel shall conform to the Standard Specifications of the American Society for Testing Materials for Structural Steel for Buildings, Serial Designation A 9-21, as amended to date.

4. Loading.—(*a*) Steel structures shall be designed to sustain the dead weight imposed upon them, including the weight of the steel frame itself, and, in addition, the maximum live load as specified in each particular case. Proper provision shall be made for temporary stresses caused by erection.

[1] The 40 per cent is the average ratio between No. 1 heavy melting steel scrap and finished plate prices in the United States over a period of 15 yr.

(*b*) In cases where live loads have the effect of producing impact or vibration, a proper percentage shall be added to the static live load stresses to provide for such influences, so that the total stress found in any member is an equivalent static stress.

(*c*) Proper provision shall be made for stresses caused by wind both during erection and after completion of the building. The wind pressure is dependent upon the conditions of exposure, but the allowable stresses specified in section five (5), paragraphs (*f*) and (*g*), are based upon the steel frame being designed to carry a wind pressure of not less than twenty (20) pounds per square foot on the vertical projection of exposed surfaces during erection, and fifteen (15) pounds per square foot on the vertical projection of the finished structure.

(*d*) Proper provision shall be made to fasten securely the reaction points of all steel construction and transmit the stresses to the foundations of the structure.

5. Allowable Stresses.—All parts of the structure shall be so proportioned that the sum of the maximum static stresses in pounds per square inch shall not exceed the following:

(*a*) *Tension.*—Rolled Steel, on net section..... 18,000

(*b*) *Compression.*—Rolled Steel, on short lengths or where lateral deflection is prevented..... 18,000

On gross section of columns,

$$1 + \frac{\frac{18{,}000}{l^2}}{18{,}000r^2}$$

with a maximum of..... 15,000

In which l is the unsupported length of the column, and r is the corresponding least radius of gyration of the section, both in inches.

For main compression members, the ratio $\frac{l}{r}$ shall not exceed 120, and for bracing and other secondary members, 200.

(*c*) *Bending.*—On extreme fibers of rolled shapes, and built up sections, net section, if lateral deflection is prevented..... 18,000

When the unsupported length l exceeds 15 times b, the width of the compression flange, the stress in pounds per square inch in the latter shall not exceed

$$1 + \frac{\frac{20{,}000}{l^2}}{2{,}000b^2}$$

The laterally unsupported length of beams and girders shall not exceed 40 times b the width of the compression flange.

On extreme fibers of pins, when the forces are assumed as acting at the center of gravity of the pieces 27,000

(*d*) *Shearing.*—On pins 13,500

On power-driven rivets 13,500

On turned bolts in reamed holes with a clearance of not more than $\frac{1}{50}$ of an inch 13,500

On hand-driven rivets 10,000

On unfinished bolts 10,000

On the gross area of the webs of beams and girders, where h, the height between flanges, in inches, is not more than 60 times t, the thickness of the web in inches 12,000

On the gross area of the webs of beams and girders if the web is not stiffened where h, the height between flanges in inches, is more than 60 times t, the thickness of the web, the maximum shear per square inch, S/A shall not exceed

$$1 + \frac{\frac{18{,}000}{h^2}}{\frac{7{,}200t^2}{}}$$

In which S is the total shear, and A is gross area of web in square inches.

	Double Shear	Single Shear
(*e*) *Bearing.*—On pins	30,000	24,000
On power-driven rivets	30,000	24,000
On turned bolts in reamed holes	30,000	24,000
On hand-driven rivets	20,000	16,000
On unfinished bolts	20,000	16,000

On expansion rollers per lineal inch 600 times the diameter of the roller in inches.

(*f*) *Combined Stresses.*—For combined stresses due to wind and other loads, the permissible working stress may be increased 33⅓ per cent, provided the section thus found is not less than that required by the dead and live loads alone.

(*g*) *Members Carrying Wind Only.*—For members carrying wind stresses only, the permissible working stresses may be increased 33⅓ per cent.

6. Symmetrical Members.—Sections shall preferably be symmetrical.

7. Beams and Girders.—(*a*) *Rolled beams* shall be proportioned by the moment of inertia of their net section. Plate girders with webs fully spliced for tension and compression shall be so proportioned that the unit stress on the net section does not exceed the stresses specified in section five (5) as determined by the moment of inertia of the net section.

(*b*) *Plate girder webs* shall have a thickness of not less than 1–160 of the unsupported distance between the flanges.

(*c*) *Web splices* shall consist of a plate on each side of the web capable of transmitting the full stress through the splice rivets.

(*d*) *Stiffeners.*—Stiffeners shall be required on the webs of rolled beams and plate girders at the ends and at points of concentrated loads, and at other points where h the clear distance between flanges is greater than $85t\sqrt{18{,}000\ (A/S)-1}$, in which t is the thickness of the web. When stiffeners are required, the distance in inches between them shall not be greater than $85t\sqrt{18{,}000\ (A/S)-1}$, or not greater than 6 ft. When h is greater than 60 times t the thickness of the web of a plate girder, stiffeners shall be required at distances not greater than 6 ft. apart. Stiffeners under or over concentrated loads shall be proportioned to distribute such loads into the web.

Plate girder stiffeners shall generally be in pairs, one on each side of the web, and shall have a close bearing against the flange angles at points of concentrated loading; stiffeners over the end bearings shall be on plate fillers. The pitch of rivets in stiffeners shall not exceed 6 in.

(*e*) *Flange plates* of all girders shall be limited in width so as not to extend more than 6 in. or more than 12 times the thickness of thinnest plate beyond the outer row of rivets connecting them to the angles.

(*f*) *Crane runway girders* and the supporting framework shall be proportioned to resist the greatest horizontal stresses caused by the operation of the cranes.

(*g*) *Rivets* connecting the flanges to the web at points of direct load on the flange between stiffeners shall be proportioned to carry the resultant of the longitudinal and transverse shears.

(*h*) *Rivets* connecting the flanges to the webs of plate girders and of columns subjected to bending shall be so spaced as to carry the increment of the flange stress between the rivets.

8. Column Bases.—(*a*) Proper provision shall be made to distribute the column loads on the footings and foundations.

(*b*) The top surface of all column bases shall be planed for the column bearing.

(*c*) Column bases shall be set true and level, with full bearing on the masonry, and be properly secured to the footings.

9. Eccentric Loading.—Full provision shall be made for stresses caused by excentric loads.

10. Combined Stresses.—(*a*) Members subject to both direct and bending stresses shall be so proportioned that the greatest combined stresses shall not exceed the allowed limits.

(*b*) All members and their connections which are subject to stresses of both tension and compression due to the action of live loads shall be

designed to sustain stress giving the largest section, with 50 per cent of the smaller stress added to it. If the reversal of stress is due to the action of wind, the member shall be designed for the stress giving the largest section and the connections proportioned for the largest stress.

11. Abutting Joints.—Compression members when faced for bearings shall be spliced sufficiently to hold the connecting members accurately in place. Other joints in riveted work, whether in tension or compression, shall be fully spliced.

12. Net Sections.—(*a*) In calculating tension members, the net section shall be used, and in deducting the rivet holes they shall be taken $\frac{1}{8}$ in. greater in diameter than the nominal diameter of the rivets.

(*b*) Pin-connected tension members shall have the section through the pin hole 25 per cent in excess of the net section of the member, and a net section back of the pin hole equal to 75 per cent of that required through the pin hole.

13. Rivets and Bolts.—(*a*) In proportioning rivets, the nominal diameter of the rivet shall be used.

(*b*) Rivets carrying calculated stresses, and whose grip exceeds five diameters, shall have their number increased 1 per cent for each additional $\frac{1}{10}$ in. in the rivet grip. Special care shall be used in heating and driving such rivets.

(*c*) Rivets shall be used for the connections of main members carrying live loads which produce impact, and for connections subject to reversal of stresses.

(*d*) Finished bolts in reamed holes may be used in shop or field work where it is impracticable to obtain satisfactory power-driven rivets. The finished shank shall be long enough to provide full bearing, and washers used under the nuts to give full grip when turned tight.

Unfinished bolts may be used in shop or field work for connections in small structures used for shelters, and for secondary members of all structures such as purlins, girts, door and window framing, alignment bracing and secondary beams in floor.

14. Rivet Spacing.—(*a*) The minimum distance between centers of rivet holes shall be three diameters of the rivet; but the distance shall preferably be not less than $4\frac{1}{2}$ in. for $1\frac{1}{4}$-in. rivets, 4 in. for $1\frac{1}{8}$-in. rivets, $3\frac{1}{2}$ in. for 1-in. rivets, 3 in. for $\frac{7}{8}$-in. rivets, $2\frac{1}{2}$ in. for $\frac{3}{4}$-in. rivets, 2 in. for $\frac{5}{8}$-in. rivets, and $1\frac{3}{4}$ in. for $\frac{1}{2}$-in. rivets. The maximum pitch in the line of stress of compression members composed of plates and shapes shall not exceed 16 times the thinnest outside plate or shape, nor 20 times the thinnest enclosed plate or shape with a maximum of 12 in., and at right angles to the direction of stress the distance between lines of rivets shall not exceed 30 times the thinnest plate or shape. For angles in built sections with two gage lines, with rivets staggered, the

maximum pitch in the line of stress in each gage line shall not exceed 24 times the thinnest plate with a maximum of 18 in.

(*b*) In tension members composed of two angles, a pitch of 3 ft. 6 in. will be allowed, and in compression members, 2 ft. 0 in., but the ratio l/r for each angle between rivets shall not be more than three-fourths of that for the whole member.

(*c*) The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivets for a length equal to 1½ times the maximum width of the member.

(*d*) The minimum distance from the center of any rivet hole to a sheared edge shall be 2⅞ in. for 1¼-in. rivets, 2 in. for 1⅛-in. rivets, 1¾ in. for 1 in. rivets, 1½ in. for ⅞-in. rivets, 1¼ in. for ¾-in. rivets, 1⅛ in. for ⅝-in. rivets, and 1 in. for ½-in. rivets. The maximum distance from any edge shall be 12 times the thickness of the plate, but shall not exceed 6 in.

15. Connections—(*a*) Connections carrying calculated stresses except for lacing, sag bars, or angles, hand rails, or beam connections, shall not have less than 2 rivets; or for field connections not less than 3 rivets.

(*b*) Members meeting at a joint shall have their lines of center of gravity meet at a point if practicable; if not, provision shall be made for any eccentricity.

(*c*) The rivets at the ends of any member transmitting the stresses into that member should have their centers of gravity in the line of the center of gravity of the member; if not, provision shall be made for the effect of the resulting eccentricity. Pins may be so placed as to counteract the effect of bending due to dead load.

(*d*) When a beam or girder *A* is connected to another member in such a manner that *A* acts as a continuous or fixed end beam, proper provision shall be made for the bending moments at such a connection.

(*e*) Where stress is transmitted from one piece to another, through a loose filler, the number of rivets shall be properly increased; tight-fitting fillers shall be preferred.

16. Lattice.—(*a*) The open sides of compression members shall be provided with lattice having tie plates at each end and at intermediate points if the lattice is interrupted. Tie plates shall be as near the ends as practicable. In main members carrying calculated stresses the end tie plates shall have a length of not less than the distance between the lines of rivets connecting them to the flanges, and intermediate ones of not less than one-half of this distance. The thickness of tie plates shall not be less than one-fiftieth of the distance between the lines of rivets connecting them to the segments of the members, and the rivet pitch shall not be more than four diameters. Tie plates shall be sufficient in size and number to equalize the stress in the parts of the members.

(*b*) Lattice bars shall have neatly finished ends. The thickness of lattice bars shall be not less than one-fortieth for single lattice and one-sixtieth for double lattice of the distance between end rivets; their minimum width shall be as follows:

For 15-in. channels, or built sections with 3½- and 4-in. angles—2¼ in. (¾-in. rivets), or 2½ in. (⅞-in. rivets).

For 12-in, 10-in, and 9-in. channels, or built sections with 3-in. angles—2¼ in. (¾-in. rivets).

For 8-in. and 7-in. channels, or built sections with 2½-in. angles—2 in. (⅝-in. rivets), or 2¼ in. (¾-in. rivets).

For 6-in. and 5-in. channels, or built sections with 1-in. angles—1½ in. (½-in. rivets), or 1¾ in. (⅝-in. rivets).

(*c*) The inclination of lattice bars to the axis of the members shall generally be not less than 45 deg.; but when the distance between the rivet lines in the flanges is more than 15 in., the lattice shall be double and riveted at the intersection if bars are used, or else shall be made of angles.

(*d*) Lattice bars shall be so spaced that the ratio l/r of the flange included between their connections shall be not over three-fourths of that of themember as a whole.

17. Expansion.—Proper provision shall be made for expansion and contraction.

18. Minimum Thickness.—No steel less than 5/16 in. thick shall be used for exterior construction, nor less than ¼ in. for interior construction, except for linings or fillers and rolled structural shapes.

These provisions do not apply to light structures such as skylights, marquees, fire-escapes, light one-story buildings, or light miscellaneous steel work.

For trusses having end reactions of 35,000 lb. or over, the gusset plates shall be not less than ⅜ in. thick.

19. Adjustable Members.—The initial stress in adjustable members shall be assumed as not less than 5,000 lb.

20. Workmanship.—(*a*) All workmanship shall be equal to the best practice in modern structural shops.

(*b*) Drifting to enlarge unfair holes shall not be permitted.

(*c*) The several pieces forming built sections shall be straight and fit close together; and finished members shall be free from twists, bends, or open joints.

(*d*) Rolled sections, except for minor details, shall not be heated.

(*e*) Wherever steel castings are used, they shall be properly annealed.

(*f*) *Punching.*—Material may be punched 1/16 in. larger than the nominal diameter of the rivets, whenever the thickness of the metal is equal to or less than the diameter of the rivets, plus ⅛ in. When the

metal is thicker than the diameter of the rivet, plus $\frac{1}{8}$ in., the holes shall be drilled, or sub-punched and reamed.

(*g*) Rivets are to be driven hot, and wherever practicable, by power. Rivet heads shall be of hemispherical shape and uniform size throughout the work for the same size rivet, full, neatly finished, and concentric with the holes. Rivets, after driving, shall be tight, completely filling the holes, and with heads in full contact with the surface.

(*h*) Compression joints depending upon contact bearing shall have the bearing surfaces truly faced after the members are riveted. All other joints shall be cut or dressed true and straight, especially where exposed to view.

(*i*) The use of a burning torch is permissible if the burned metal is not carrying stresses during the burning. Stresses shall not be transmitted into the metal through a burned surface.

21. Painting.—(*a*) Parts not in contact, but inaccessible after assembling, shall be properly protected by paint.

(*b*) All steelwork, except where encased in concrete, shall be thoroughly cleaned and given one coat of acceptable metal protection well worked into the joints and open spaces.

(*c*) Machine-finished surfaces shall be protected against corrosion.

(*d*) Field painting is a phase of maintenance, but it is important that unless otherwise properly protected, all steel work shall after erection be protected by a field coat of good paint applied by a competent painter.

22. Erection.—(*a*) The frame of all steel skeleton buildings shall be carried up true and plumb, and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment, and the operation of same. Such bracing shall be left in place as long as may be required for safety.

(*b*) As erection progresses the work shall be securely bolted up to take care of all dead load, wind and erection stresses.

(*c*) Wherever piles of material, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from the same.

(*d*) No riveting shall be done until the structure has been properly aligned.

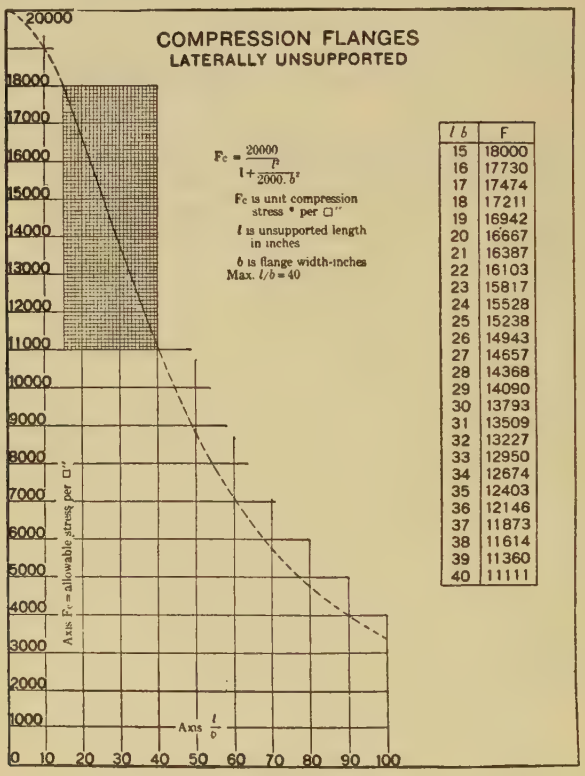
(*e*) Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.

23. Inspection.—(*a*) Material and workmanship at all times shall be subject to the inspection of experienced engineers representing the purchaser.

(*b*) Material or workmanship not conforming to the provisions of this Specification shall be rejected at any time defects are found during the progress of the work.

(*c*) The Contractor furnishing such material or doing such work shall promptly replace the same.

(*d*) All inspection as far as possible shall be made at the place of manufacture, and the Contractor or Manufacturer shall cooperate with the Inspector, permitting access for inspection to all places where work is being done.



l/b	F
15	18000
16	17730
17	17474
18	17211
19	16942
20	16667
21	16387
22	16103
23	15817
24	15528
25	15238
26	14943
27	14657
28	14368
29	14090
30	13793
31	13509
32	13227
33	12950
34	12674
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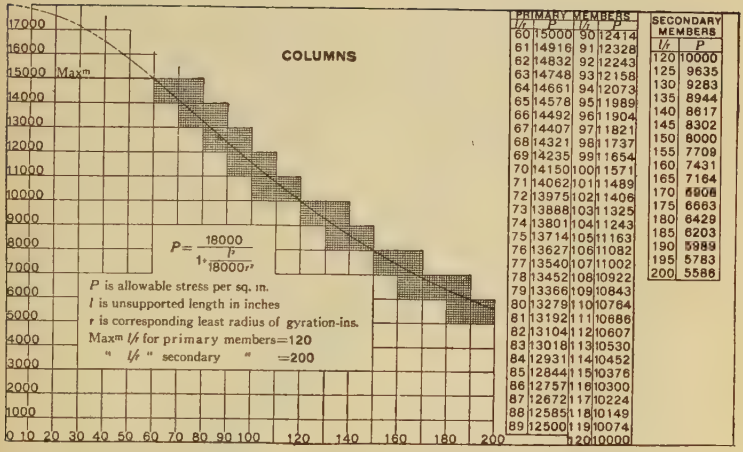
36	12146
37	11873
38	11614
39	11360
40	11111

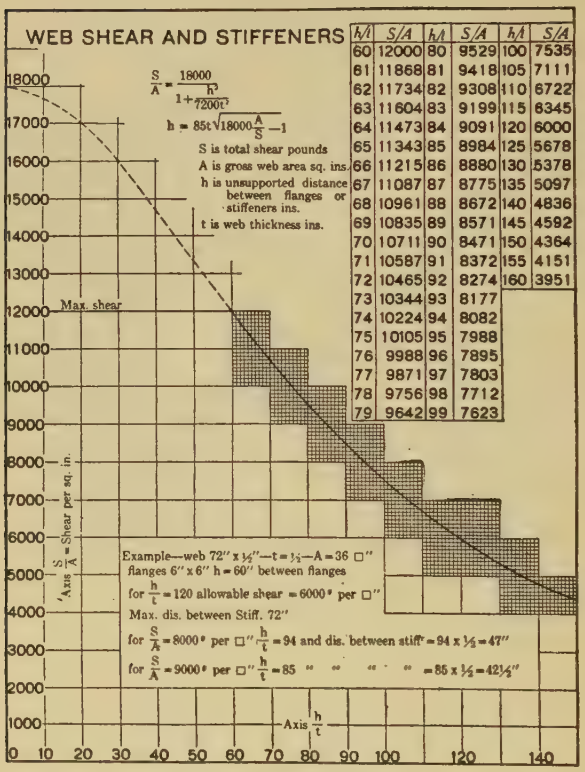
FIG. 2.



PRIMARY MEMBERS			
l/r	P	l/r	P
60	15000	90	12414
61	14916	91	12328
62	14832	92	12243
63	14748	93	12158
64	14661	94	12073
65	14578	95	11989
66	14492	96	11904
67	14407	97	11821
68	14321	98	11737
69	14235	99	11654
70	14150	100	11571
71	14062	101	11489
72	13975	102	11406
73	13888	103	11325
74	13801	104	11243
75	13714	105	11163
76	13627	106	11082
77	13540	107	11002
78	13452	108	10922
79	13366	109	10843
80	13279	110	10764
81	13192	111	10686
82	13104	112	10607
83	13018	113	10530
84	12931	114	10452
85	12844	115	10376
86	12757	116	10300
87	12672	117	10224
88	12585	118	10149
89	12500	119	10074
		120	10000

SECONDARY MEMBERS	
l/r	P
120	10000
125	9635
130	9283
135	8944
140	8617
145	8302
150	8000
155	7709
160	7431
165	7164
170	6908
175	6663
180	6429
185	6203
190	5989
195	5783
200	5586

FIG. 3.



h/t	S/A	h/t	S/A	h/t	S/A
60	12000	80	9529	100	7535
61	11868	81	9418	105	7111
62	11734	82	9308	110	6722
63	11604	83	9199	115	6345
64	11473	84	9091	120	6000
65	11343	85	8984	125	5678
66	11215	86	8880	130	5378
67	11087	87	8775	135	5097
68	10961	88	8672	140	4836
69	10835	89	8571	145	4592
70	10711	90	8471	150	4364
71	10587	91	8372	155	4151
72	10465	92	8274	160	3951
73	10344	93	8177		
74	10224	94	8082		
75	10105	95	7988		
76	9988	96	7895		
77	9871	97	7803		
78	9756	98	7712		
79	9642	99	7623		

FIG. 4.

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Wind Stresses
Alone—Sec. 5 (*g*)
Combined—Sec. 5 (*f*)

APPENDIX

AMERICAN SOCIETY FOR TESTING MATERIALS

1315 Spruce Street, Philadelphia, Pa.

STANDARD SPECIFICATIONS FOR STRUCTURAL STEEL FOR BUILDINGS

Serial Designation: A 9-21

These specifications are issued under the fixed designation A 9; the final number indicates the year of original adoption as standard, or in the case of revision, the year of last revision.

Adopted, 1901; Revised, 1909, 1913, 1914, 1916, 1921.

I. Manufacture

Process

1. (*a*) Structural steel, except as noted in Paragraph (*b*), shall be made by either or both the following processes: Bessemer or open-hearth.

(*b*) Rivet steel, and steel for plates or angles over $^3/_4$ in. in thickness which are to be punched, shall be made by the open-hearth process.

II. Chemical Properties and Tests

Chemical Composition

2. The steel shall conform to the following requirements as to chemical composition:

		Structural Steel	Rivet Steel
Phosphorus	Bessemer	not over 0.10 per cent	
	Open-hearth	not over 0.06 per cent	not over 0.06 per cent
Sulfur		not over 0.045 per cent	

Ladle Analyses

3. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of carbon, manganese, phosphorus and sulfur. This analysis shall be made from a test ingot taken during the pouring of the melt. The chemical composition thus determined shall be reported to the purchaser or his representative, and shall conform to the requirements specified in Sec. 2.

Check Analyses

4. Analyses may be made by the purchaser from finished material representing each melt. The phosphorus and sulfur content thus

determined shall not exceed that specified in Sec. 2 by more than 25 per cent.

III. Physical Properties and Tests

Tension Tests

5. (*a*) The material shall conform to the following requirements as to tensile properties:

Properties considered	Structural steel	Rivet steel
Tensile strength, pounds per square inch	55,000—65,000	46,000—56,000
Yield point, minimum pounds per square inch	0.5 tens. str.	0.5 tens. str.
Elongation in 8 in., minimum, per cent	$\frac{1,400,000}{\text{Tens. str.}}$[1]	$\frac{1,400,000}{\text{Tens. str.}}$
Elongation in 2 in., minimum, per cent	22	

[1] See Sec. 6.

(*b*) The yield point shall be determined by the drop of the beam of the testing machine.

Modifications in Elongation

6. (*a*) For structural steel over $\frac{3}{4}$ in. in thickness, a deduction from the percentage of elongation in 8 in. specified in Sec. 5 (*a*) of 0.25 per cent shall be made for each increase of $\frac{1}{32}$ in. of the specified thickness above $\frac{3}{4}$ in., to a minimum of 18 per cent.

(*b*) For structural steel under $\frac{5}{16}$ in. in thickness, a deduction from the percentage of elongation in 8 in. specified in Sec. 5 (*a*) of 1.25 per cent shall be made for each decrease of $\frac{1}{32}$ in. of the specified thickness below $\frac{5}{16}$ in.

Bend Tests

7. (*a*) The test specimen for plates, shapes and bars, except as specified in Paragraphs (*b*) and (*c*), shall bend cold through 180 deg. without

cracking on the outside of the bent portion, as follows: For material ¾ in. or under in thickness, flat on itself; for material over ¾ in. to and including 1¼ in. in thickness, around a pin the diameter of which is equal to the thickness of the specimen; and for material over 1¼ in. in thickness, around a pin the diameter of which is equal to twice the thickness of the specimen.

(*b*) The 1- by ½-in. test specimen for pins, rollers and other bars, when prepared as specified in Sec. 8, shall withstand being bent cold through 180 deg. around a pin 1 in. in diameter without cracking on the outside of the bent portion.

(*c*) The test specimen for rivet steel shall bend cold through 180 deg. flat on itself without cracking on the outside of the bent portion.

Test Specimens

8. (*a*) Test specimens shall be prepared for testing from the material in its rolled or forged condition, except when it is specified to be annealed; in which case the test specimens shall be prepared from the material as annealed for use, or from a short length of a full section similarly treated.

(*b*) Test specimens shall be taken longitudinally and, except as specified in Paragraphs (*d*), (*e*), and (*f*), shall be of the full thickness or diameter of material as rolled.

(*c*) Test specimens for plates, shapes and flats may be machined to the form and dimensions shown in Fig. 5, or with both edges parallel.

(*d*) Test specimens for plates over 1½ in. in thickness may be machined to a thickness or diameter of at least ¾ in. for a length of at least 9 in.

(*e*) Test specimens for bars over 1½ in. in thickness or diameter may be machined to a thickness or diameter of at least ¾ in. for a length of at least 9 in.; or tension test specimens may conform to the dimensions shown in Fig. 6, in which case the ends shall be of a form to fit the holders of the testing machine in such a way that the load shall be axial. Bend test specimens may be 1 by ½ in. in section.

(*f*) Tension test specimens for pins and rollers shall conform to the dimensions shown in Fig. 6. In this case, the ends shall be of a form to fit the holders of the testing machine in such a way that the load shall be axial. Bend test specimens shall be 1 by ½ in. in section.

(*g*) The tension test specimen shown in Fig. 6 and the 1- by ½-in. bend test specimen for pins and rollers shall be taken so that the axis is 1 in. from the surface; and for other bars over 1½ in. in thickness or diameter, midway between the center and surface.

(*h*) The machined sides of rectangular bend test specimens may have the corners rounded to a radius not over $\frac{1}{16}$ in.

(*i*) Test specimens for rivet bars which have been cold drawn shall be normalized before testing.

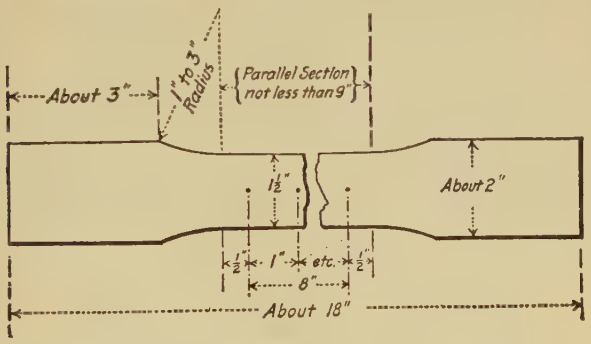


FIG. 5.

Number of Tests

9. (*a*) One tension and one bend test shall be made from each melt; except that if material for one melt differs $\frac{3}{8}$ in. or more in thickness, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

(*b*) If any test specimen shows defective machining or develops flaws it may be discarded and another specimen substituted.

(*c*) If the percentage of elongation of any tension test specimen is less than that specified in Sec. 5 (*a*) and any part of the fracture is more than $\frac{3}{4}$ in. from the center of the gage length of a 2-in. specimen or is outside the middle third of the gage length of an 8-in. specimen, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

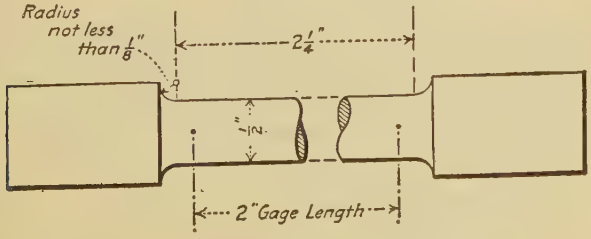


FIG. 6.

IV. Permissible Variations in Weight and Thickness

Permissible Variations

10. The cross-section or weight of each piece of steel shall not vary more than 2.5 per cent from that specified, except in the case of sheared plates, which shall be covered by the following permissible variations. One cubic inch of rolled steel is assumed to weigh 0.2833 lb.

(*a*) *When Ordered to Weight per Square Foot.*—The weight of each lot[1] in each shipment shall not vary from the weight ordered more than the amount given in Table XIX.

(*b*) *When Ordered to Thickness.*—The thickness of each plate shall not vary more than 0.01 in. under that ordered.

The overweight of each lot[2] in each shipment shall not exceed the amount given in Table XX.

V. Finish

Finish

11. The finished material shall be free from injurious defects and shall have a workmanlike finish.

VI. Marking

Marking

12. The name or brand of the manufacturer and the melt number shall be legibly stamped or rolled on all finished material, except that rivet and lattice bars and other small sections shall, when loaded for shipment, be properly separated and marked for identification. The identification marks shall be legibly stamped on the end of each pin and roller. The melt number shall be legibly marked, by stamping if practicable, on each test specimen.

VII. Inspection and Rejection

Inspection

13. The inspector representing the purchaser shall have free entry at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturers' works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the

[1] The term "lot" applied to Table XIX means all of the plates of each group width and group weight.

[2] The term "lot" applied to Table XX means all of the plates of each group width and group thickness.

TABLE XIX.—PERMISSIBLE VARIATIONS OF PLATES ORDERED TO WEIGHT

Ordered weight, pounds per square foot	Permissible variations in average weights per square foot of plates for widths given, expressed in percentages of ordered weights																		Ordered weight, pounds per square foot
	Under 48 in.		48 to 60 in., exclusive		60 to 72 in., exclusive		72 to 84 in., exclusive		84 to 96 in., exclusive		96 to 108 in., exclusive		108 to 120 in., exclusive		120 to 132 in., exclusive		132 in. or over		
	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	
Under 5	5	3	5.5	3	6	3	7	3	....	....	....	....	....	....	....	....	....	....	Under 5
5 to 7.5 exclusive	4.5	3	5	3	5.5	3	6	3	....	....	....	....	....	....	....	....	....	....	5 to 7.5 exclusive
7.5 to 10 exclusive	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3	....	....	....	....	7.5 to 10 exclusive
10 to 12.5 exclusive	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3	9	3	10 to 12.5 exclusive
12.5 to 15 exclusive	3	2.5	3.5	2½	4	3	4½	3	5	3	5½	3	6	3	7	3	8	3	12.5 to 15 exclusive
15 to 17.5 exclusive	2.5	2.5	3	2½	3½	2½	4	3	4½	3	5	3	5½	3	6	3	7	3	15 to 17.5 exclusive
17.5 to 20 exclusive	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	17.5 to 20 exclusive
20 to 25 exclusive	2	2	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	20 to 25 exclusive
25 to 30 exclusive	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3	5	3	25 to 30 exclusive
30 to 40 exclusive	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3	30 to 40 exclusive
40 or over	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	40 or over

NOTE.—The weight per square foot of individual plates shall not vary from the ordered weight by more than 1½ times the amount given in this table.

TABLE XX.—PERMISSIBLE OVERWEIGHTS OF PLATES ORDERED TO THICKNESS

Ordered thickness, inches	Permissible excess in average weights per square foot of plates for widths given, expressed in percentages of nominal weights									Ordered thickness, inches
	Under 48 in.	48 to 60 in., exclusive	60 to 72 in., exclusive	72 to 84 in., exclusive	84 to 96 in., exclusive	96 to 108 in., exclusive	108 to 120 in., exclusive	120 to 132 in., exclusive	132 in. or over	
Under 1/8	9.0	10.0	12.0	14.0	....	....	....	....	....	Under 1/8
1/8 to 3/16 exclusive	8.0	9.0	10.0	12.0	....	....	....	....	....	1/8 to 3/16 exclusive
3/16 to 1/4 exclusive	7.0	8.0	9.0	10.0	12.0	....	....	....	....	3/16 to 1/4 exclusive
1/4 to 5/16 exclusive	6.0	7.0	8.0	9.0	10.0	12.0	14	16	19	1/4 to 5/16 exclusive
5/16 to 3/8 exclusive	5.0	6.0	7.0	8.0	9.0	10.0	12	14	17	5/16 to 3/8 exclusive
3/8 to 7/16 exclusive	4.5	5.0	6.0	7.0	8.0	9.0	10	12	15	3/8 to 7/16 exclusive
7/16 to 1/2 exclusive	4.0	4.5	5.0	6.0	7.0	8.0	9	10	13	7/16 to 1/2 exclusive
1/2 to 5/8 exclusive	3.5	4.0	4.5	5.0	6.0	7.0	8	9	11	1/2 to 5/8 exclusive
5/8 to 3/4 exclusive	3.0	3.5	4.0	4.5	5.0	6.0	7	8	9	5/8 to 3/4 exclusive
3/4 to 1 exclusive	2.5	3.0	3.5	4.0	4.5	5.0	6	7	8	3/4 to 1 exclusive
1 or over	2.5	2.5	3.0	3.5	4.0	4.5	5	6	7	1 or over

material is being furnished in accordance with these specifications. All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

Rejection

14. (*a*) Unless otherwise specified, any rejection based on tests made in accordance with Sec. 4 shall be reported within five working days from the receipt of samples.

(*b*) Material which shows injurious defects subsequent to its acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

Rehearing

15. Samples tested in accordance with Sec. 4, which represent rejected material, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

CHAPTER XI

ROUGH CARPENTRY

MAKING THE ESTIMATE

Material.—In estimating carpentry work it naturally resolves itself into two parts, *i.e.* the material and the labor, and in general the labor is far more difficult to figure than the material. In any case the first thing an estimator should do is to prepare a careful bill of material, keeping each kind of material separate that will require a different unit price either for the material or for the labor.

Items to Be Included.—The items to be looked for in rough carpentry are as follows: Framing, wall plates, studding, girders, joists, bridging, rafters, trusses, sleepers, purlins, braces, ridges, hip and valley pieces, siding, sheathing, furring, underflooring, deadening felt or quilt, finished floors, parquet floors, posts and columns, grounds, rough bucks, window and door frames, mason's centers, temporary enclosures, temporary stairs, rough stairs, woodwork for plumbing, calking with oakum, wood furring, gutter lining, cornice lining, closets, refrigerators, shelving, ventilators, louvers, chutes, trench covers, flag poles, lattice work and cutting and fitting for other trades.

Waste in Lumber.—Lumber is usually sold by the board foot which is a piece 12 in. wide by 12 in. long by 1 in. thick or any other piece containing an equal amount of lumber, and when less than 1 in. thick, it is figured the same as for 1-in. material. In buying dressed lumber the amount charged for is always the amount of rough stock required to do the work, and hence when any surface is to be covered with dressed lumber, it is necessary to take care of waste. The percentage of waste is found by dividing the difference in width of the rough board and the exposed face by the width of the exposed face. To illustrate: If a 4-in. board is used for flooring and has a face width of $3\frac{1}{4}$ in., the percentage of waste is 0.75 times 100 divided by 3.25 which equals 23.08 per cent.

If, however, a 4-in. board is used as a bevel siding with 2½ in. to the weather, the percentage of waste is 1.5 times 100 divided by 2.5, which equals 60 per cent. In addition to the waste for dressing, it is necessary to add for sorting, cutting, etc. This usually is about 5 per cent, but for certain kinds of work such as diagonal sheathing it may run as high as 10 per cent.

The accompanying table gives the usual reduction in width and thickness for dressing of the more common kinds of lumber and the net loss due to reduction in width. An additional 5 or 10 per cent for sorting, cutting, etc. must be added to the amounts shown in the table. This sorting and cutting waste should also be added to framing lumber. Some contractors add very little, if anything, to lists of heavy timber when the grading is high, especially when the lumber yard is handy, so that any extra pieces that may be required can be secured on short notice.

Estimating Lumber Quantities.—In listing lumber it is customary to give the quantity first, then the width and thickness in inches and the length in feet last, *i.e.*, 16 pieces 2 by 6 in. by 12f t. 0 in. To obtain the board feet in any piece of timber, the width and thickness in inches are multiplied by the length in feet and divided by 12:

$$\frac{2 \times 6 \times 12}{12} = 12 \text{ f.b.m.}$$

If there is more than one piece, the number is included, thus:

$$\frac{16 \times 2 \times 6 \times 12}{12} = 192 \text{ f.b.m.}$$

After a little practice most of the answers can be obtained by mental calculation.

Listing of Lumber.—In making up a bill of lumber, it is necessary to specify the commercial lengths, which are the even feet from 10 to 18 ft. for the northern or hardwood and extending to 20 or 22 ft. for yellow pine. If ordered direct from the mill, yellow pine can be gotten considerably longer than 22 ft. at an extra cost of about $1 per M.B. ft. for each additional foot in length.

Estimating Studding.—Studs are usually spaced 16 in. on centers for plastered buildings and 2 ft. or more for buildings left unfinished or sheathed. In any case they should be doubled at corners and around openings. For 16-in. spacing a common rule is to add together the length of all walls and partitions having the same size and length

TABLE I.—TABLE SHOWING DIMENSIONS OF DRESSED AND MILLED LUMBER INCLUDING PERCENTAGE OF WASTE FOR DRESSING

Width	2-in.	3-in.	4-in.	6-in.	8-in.	10-in.	12-in.
FLOORING D & M (T & G)							
Thickness, in.							
3/8	Hardwoods	5/16 by 2 3/8	5/16 by 3 1/4	5/16 by 5 1/4			
1/2	.....	7/16 by 2 3/8	7/16 by 3 1/4	7/16 by 5 1/4			
5/8	9/16 by 2 1/4	9/16 by 2 3/8	9/16 by 3 1/4	9/16 by 5 1/4			
1	1 3/16 by 2 1/4	1 3/16 by 2 3/8	1 3/16 by 3 1/4	1 3/16 by 5 1/4			
1 1/4	1 1/16 by 2 1/4	1 1/16 by 2 3/8	1 1/16 by 3 1/4	1 1/16 by 5 1/4			
1 1/2	1 5/16 by 2 1/4	1 5/16 by 2 3/8	1 5/16 by 3 1/4	1 5/16 by 5 1/4			
2	1 11/16 by 2 1/4	1 5/8 by 2 3/8	1 5/8 by 3 1/4	1 5/8 by 5 1/4			
2 1/2	.....	2 1/8 by 2 3/8	2 1/8 by 3 1/4	2 1/8 by 5 1/4			
3	.....	2 5/8 by 2 3/8	2 5/8 by 3 1/4	2 5/8 by 5 1/4			
	Waste 33 1/3 per cent	26.3	23.1	14.3			
FLOORING—SPLINED							
2	.....	.....	.....	1 5/8 by 5 1/2	1 5/8 by 7 1/2	1 5/8 by 9 1/2	1 5/8 by 11 1/2
2 1/2	.....	.....	.....	2 1/8 by 5 1/2	2 1/8 by 7 1/2	2 1/8 by 9 1/2	2 1/8 by 11 1/2
3	.....	.....	.....	2 5/8 by 5 1/2	2 5/8 by 7 1/2	2 5/8 by 9 1/2	2 5/8 by 11 1/2
4	.....	.....	.....	3 5/8 by 5 1/2	3 5/8 by 7 1/2	3 5/8 by 9 1/2	3 5/8 by 11 1/2
	Waste, per cent	.....	.....	9.1	6.7	5.3	4.4
SHIPLAP—RABBETTED 3/8 IN.							
1	.....	.....	3/4 by 3 1/8	3/4 by 5 1/8	3/4 by 7 1/8	3/4 by 9 1/8	3/4 by 11 1/8
	Waste, per cent	.....	28.0	17.1	12.3	9.6	7.9
SHIPLAP—RABBETTED 1/2 IN.							
2	.....	.....	1 5/8 by 3	1 5/8 by 5	1 5/8 by 7	1 5/8 by 9	1 5/8 by 11
	Waste, per cent	.....	33.3	20.0	14.3	11.1	9.1

Ceiling—D & M (T & G)

⅜	.....	5/16 by 2⅜	5/16 by 3¼	5/16 by 5¼			
½	.....	7/16 by 2⅜	7/16 by 3¼	7/16 by 5¼			
⅝	.....	9/16 by 2⅜	9/16 by 3¼	9/16 by 5¼			
1	.....	¾ by 2⅜	¾ by 3¼	¾ by 5¼			
	Waste, per cent	26.3	23.1	14.3			

Drop Siding—D & M (T & G)

⅝	.....	9/16 by 2⅜	9/16 by 3¼	9/16 by 5¼			
1	.....	¾ by 2⅜	¾ by 3¼	¾ by 5¼			
	Waste, per cent	26.3	23.1	14.3			

Drop Siding Worked Shiplap or Rustic

1	.....	.....	.....	¾ by 5⅛	¾ by 7⅛	¾ by 9⅛	
	Waste, per cent	.....	.....	17.1	12.3	9.6	

Grooved Roofing

	Waste, per cent	.....	.....	.....	13/16 by 7½	13/16 by 9½	13/16 by 11½
					6.7	5.3	4.4

Bevel Siding

	To weather	.....	2½	4½	6	8	10
½ & ¼	.....	.....	½ & 3/16 by 3½	½ by 3/16 by 5½			
5/8 & 1¼					5/8 & 3/16 by 7¼	5/8 & 3/16 by 9¼	5/8 & 3/16 by 11¼
	Waste, per cent	.....	60	41.2	33.3	25.0	20.0

TABLE I.—TABLE SHOWING DIMENSIONS OF DRESSED AND MILLED LUMBER INCLUDING PERCENTAGE OF WASTE FOR DRESSING.—(*Continued*)

Width	2-in.	3-in.	4-in.	6-in.	8-in.	10-in.	12-in.	14-in.
COMMON BOARDS AND STRIPS—SIS2E								
Thickness, in.								
1	.....	.....	7/8 by 3 5/8	7/8 by 5 5/8	7/8 by 7 1/2	7/8 by 9 1/2	7/8 by 11 1/2	
	Waste, per cent	.....	10.3	6.7	6.7	5.3	4.4	
COMMON BOARDS AND STRIPS—S4S								
1	.....	.....	13/16 by 3 5/8	13/16 by 5 5/8	13/16 by 7 1/2	13/16 by 9 1/2	13/16 by 11 1/2	
1 1/4	.....	.....	1 1/16 by 3 5/8	1 1/16 by 5 5/8	1 1/16 by 7 1/2	1 1/16 by 9 1/2	1 1/16 by 11 1/2	
1 1/2	.....	.....	1 5/16 by 3 5/8	1 5/16 by 5 5/8	1 5/16 by 7 1/2	1 5/16 by 9 1/2	1 5/16 by 11 1/2	
	Waste, per cent	.....	10.3	6.7	6.7	5.3	4.4	
FENCING—S4S								
1	.....	.....	13/16 by 3 5/8	13/16 by 5 5/8				
1 1/4	.....	.....	1 1/16 by 3 5/8	1 1/16 by 5 5/8				
1 1/2	.....	.....	1 5/16 by 3 5/8	1 5/16 by 5 5/8				
	Waste, per cent	.....	10.3	6.7 per cent				
DIMENSION—S4S								
2	1 5/8 by 1 5/8	1 5/8 by 2 5/8	1 5/8 by 3 5/8	1 5/8 by 5 5/8	1 5/8 by 7 1/2	1 5/8 by 9 1/2	1 5/8 by 11 1/2	1 5/8 by 13 1/2
2 1/2	.....	2 1/8 by 2 5/8	2 1/8 by 3 5/8	2 1/8 by 5 5/8	2 1/8 by 7 1/2	2 1/8 by 9 1/2	2 1/8 by 11 1/2	2 1/8 by 13 1/2

3	.....	2⅝ by 2⅝	2⅝ by 3⅝	2⅝ by 5⅝	2⅝ by 7½	2⅝ by 9½	2⅝ by 11½	2⅝ by 13½
4	.....	.....	3⅝ by 3⅝	3⅝ by 5⅝	3⅝ by 7½	3⅝ by 9½	3⅝ by 11½	3⅝ by 13½
5	.....	.....	.....	4⅝ by 5⅝	4⅝ by 7½	4⅝ by 9½	4⅝ by 11½	4⅝ by 13½
6	.....	.....	.....	5⅝ by 5⅝	5⅝ by 7½	5⅝ by 9½	5⅝ by 11½	5⅝ by 13½
8	.....	.....	.....	.....	7½ by 7½	7½ by 9½	7½ by 11½	7½ by 13½
10	.....	.....	.....	.....	.....	9½ by 9½	9½ by 11½	9½ by 13½
12	.....	.....	.....	.....	.....	.....	11½ by 11½	11½ by 13½

FINISH—S4S

⅜	.....	.....	5/16 by 3⅝	5/16 by 5⅝	5/16 by 7½			
½	.....	.....	7/16 by 3⅝	7/16 by 5⅝	7/16 by 7½			
⅝	.....	.....	9/16 by 3⅝	9/16 by 5⅝	9/16 by 7½			
¾	.....	.....	11/16 by 3⅝	11/16 by 5⅝	11/16 by 7½			
1	.....	.....	13/16 by 3⅝	13/16 by 5⅝	13/16 by 7½	13/16 by 9½	13/16 by 11½	13/16 by 13½
1¼	.....	.....	1⅛ by 3⅝	1⅛ by 5⅝	1⅛ by 7½	1⅛ by 9½	1⅛ by 11½	1⅛ by 13½
1½	.....	.....	1⅜ by 3⅝	1⅜ by 5⅝	1⅜ by 7½	1⅜ by 9½	1⅜ by 11½	1⅜ by 13½
2	.....	.....	1¾ by 3⅝	1¾ by 5⅝	1¾ by 7½	1¾ by 9½	1¾ by 11½	1¾ by 13½
2½	.....	.....	2⅛ by 3⅝	2⅛ by 5⅝	2⅛ by 7½	2⅛ by 9½	2⅛ by 11½	2⅛ by 13½
3	.....	.....	2⅝ by 3⅝	2⅝ by 5⅝	2⅝ by 7½	2⅝ by 9½	2⅝ by 11½	2⅝ by 13½
	Waste, per cent	.....	10.3	6.7	6.7	5.3	4.4	3.7

PARTITION—D & M (T & G)

⅜	.....	5/16 by 2⅜	5/16 by 3¼	5/16 by 5¼				
½	.....	7/16 by 2⅜	7/16 by 3¼	7/16 by 5¼				
⅝	.....	9/16 by 2⅜	9/16 by 3¼	9/16 by 5¼				
1	.....	¾ by 2⅜	¾ by 3¼	¾ by 5¼				
	Waste, per cent	26.3	23.1	14.3				

studs. The lineal feet of wall is multiplied by ¾ and to this one stud is added for each corner or opening. The result will be the number of studs required. A much quicker method, however, and just about as accurate is to figure as many studs as there are feet of wall and partitions.

Estimating Floor Joists.—Floor joists are usually spaced 12 or 16 in. on centers. If spaced 12 in. then the number required is the length in feet to be covered by each span of joist plus one. For instance, if a space 24 ft. long is to be floored it will require 24 + 1 or 25 joists. If the joists are spaced 16 in. on centers—the length of floor must be multiplied by ¾ and one is added, or for a run of 24 ft. we would have 24 by ¾ equals 18 and adding one gives 19 joists, the number required.

Surface Covering.—All kinds of roofing, flooring, sheathing, etc. are taken off as an area and then changed into squares, square yards, M.B. ft. etc. as required. The area of a triangle such as a gable is obtained by multiplying its width or base by one-half of its perpendicular height. Thus the area of the triangle *ABC* is the distance *AC* by ½ *BD*. (See Fig. 1.)

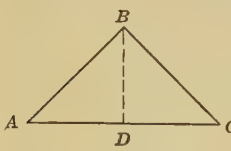


FIG. 1.

Roof Areas.—The area of a gable roof is its length times twice its slope height. A hip roof and a gable roof having the same slope and the same overhang when covering buildings of the same size, will have the same area; hence the rule for figuring the area of a hip roof is the same as for a gable roof. Dormers whose roofs have the same pitch as the main roof add to the total area of roofing only the amount of their roof overhang including the overhang at the gables and at the eaves. (See Roofing.)

Estimating Shingles.—Shingles were formerly sold in bundles of random width and the bundle was supposed to contain the equivalent of 250 shingles 4 in. wide, but usually four bundles actually contained somewhere between 925 and 1,000. The amount of roof covered varied according to length of the shingles, therefore it was always uncertain which kind of shingles were most economical to purchase.

There is at the present time, however, a determined effort to revise the method of packing shingles by making the bundle cover a uniform amount of roof for a standard exposure. This is a great improvement in every way both from the selling and from the buying standpoint. Red cedar shingles are at the present time sold by this method

and the others will, no doubt, gradually fall in line. These shingles are graded, packed and sold according to specifications prepared by the West Coast Lumbermen's Association of Seattle, Washington. The principal varieties and dimensions of random width shingles are as follows:

24-in. Royals, 8/16 in.
18-in. Perfections, 5/2¼ in.
18-in. Eurekas, 5/2 in.
16-in. Perfects, 5/2 in.
16-in. Extra Clears, 5/2 in.
16-in. Extra Star-A-Stars, 5/2 in.
16-in. Extra Star-A-Stars, 6/2 in.

The first figure in each case refers to the length of the shingles, the name indicates the quality and the figures after the name give the thickness. For instance, for Perfections five butts measure 2¼ in. thick, for Eurekas 2 in. thick and for Royals the butt measurement is ½ in. The Royals are intended for 7½ in. to the weather and three bundles lay one square. The 18-in. shingles lay 5½ in. to the weather and 16-in. shingles 5 in. to the weather. They are packed in bundles covering 25 sq. ft. or four bundles to the square.

In addition to random width shingles, there are the following sizes of dimension shingles:

Size, inches	Thickness of butt, inches	Number pieces to bunch	Exposure	Number bunches to square
24 by 6	8/16	108	7½	3
18 by 4	5/2	165	5½	4
18 by 4	5/2¼	165	5½	4
18 by 5	5/2	132	5½	4
18 by 5	5/2¼	132	5½	4
18 by 6	5/2	110	5½	4
18 by 6	5/2¼	110	5½	4
16 by 4	5/2	185	5	4
16 by 4	6/2	185	5	4
16 by 5	5/2	148	5	4
16 by 5	6/2	148	5	4
16 by 6	5/2	122	5	4
16 by 6	6/2	122	5	4

Shipping Weight of Red Cedar Shingles

	Pounds per bundle	Pounds per square
24-in. Royals, 8/16-in. and all 8/16- by 24-in. shingles	61⅓	184
Perfections, and all 18-in. 5/2¼-in. shingles	42½	170
Eurekas, and all 18-in. 5/2-in. shingles	38¼	153
Extra clears, and all 16-in. 5/2-in. shingles	37½	150
6/2-in. Extra Star-A-Stars, and all 16-in. 6/2-shingles	32	128

LABOR TO INSTALL ROUGH CARPENTRY

In estimating the number of labor hours to install "Rough Carpentry" it is necessary to take into account the class of workmanship required, the grade of labor available, and the amount and kind of supervision that will be exercised. It is also well understood that men will install more material per hour in large straight away buildings than in small buildings or those that are badly cut up with numerous partitions, wings, dormers, etc.

In preparing the accompanying tables we have assumed average conditions as to size and kind of buildings. The labor assumed was of a good grade and well supervised. In preparing these tables the writer has had the advice and assistance of not less than forty general contractors and it is believed that these tables are as accurate and as reliable as such information can be made.

Common Labor.—The tables show only the number of hours required for a carpenter to do the various kinds of work. They do not give the amount of common labor required to carry the lumber into the building and to pile it in convenient location for use, or to hoist it to the upper stories when the building is more than one-story high. The common labor has been omitted from the various items as it is far more accurate as well as much easier to figure the common labor as a uniform percentage of the carpenter labor rather than as a varying percent for each kind of work to be performed. Figuring in this way, the percentage of common labor will vary according to the

kind of a building to be erected. In heavy factory work and where the unions permit laborers to distribute the lumber for the carpenters, it sometimes is economical to have half as many laborers as carpenters while for the other extreme, in very high grade buildings of small size and badly cut up, one laborer may be able to wait on eight or ten carpenters. For average conditions, however, the assumption made in preparing these tables was that one laborer was required for each four carpenters. While this may not seem to fit each individual item it usually works out about right for the entire job.

Having determined the percentage of common labor to be used in conjunction with the carpenters, a very handy way to include it in the estimate is to add to the hourly rate for carpenters the given percentage of the rate of common labor. To illustrate: If the ratio of common labor is assumed to be 1 to 4 and the rate paid carpenters is $1 per hour and that paid common labor 60 cts. per hour, we would have $1 + ¼ of 60 cts. = $1.15. Hence, if this rate is used in pricing the carpenter labor, it will automatically take care of the common labor working with the carpenters.

Labor tables for Rough Carpentry Nos. II and III give the number of hours required under ordinary circumstances for the various kinds of work described and for the various units as specified. Table III gives the same information for items from 10 to 30 inclusive of Table II, but for 100 sq. ft. instead of M.B. ft. The waste shown is the amount caused by dressing plus 5 per cent for all work laid straight and 10 per cent for sheathing laid diagonally.

Table II.—Labor to Install Rough Carpentry

No.	Kind of work	Unit	Hours to do unit of work
1	Mortised and tenoned framing for buildings	M.B.Ft.	21
2	Studding for walls and partitions	M.B.Ft.	18
3	Floor and ceiling joists	M.B.Ft.	15
4	Rafters and framing for gable roofs	M.B.Ft.	21
5	Rafters and framing for hip and valley roofs	M.B.Ft.	27
6	Floor sleepers, bedded in sand	M.B.Ft.	22
7	Floor sleepers, bedded in concrete	M.B.Ft.	27
8	Framing and installing roof trusses, 20- to 40-ft. spans	M.B.Ft.	32
9	Installing exterior cornice work, ordinary plain	M.B.Ft.	38
10	Novelty or drop siding 5⅛ in. to the weather	M.B.Ft.	17
11	Novelty or drop siding 3¼ in. to the weather	M.B.Ft.	21
12	Clapboards or bevel siding, 4¼ in. to the weather	M.B.Ft.	18
13	Clapboards or bevel siding, 2½ in. to the weather	M.B.Ft.	25
14	Board and batten siding using 10- or 12-in. boards	M.B.Ft.	17
15	Wall sheathing 1 by 6 in. SIS2E laid straight	M.B.Ft.	12
16	Wall sheathing 1 by 6 in. SIS2E laid diagonally	M.B.Ft.	15
17	Under flooring 1 by 6 in. SIS2E laid straight	M.B.Ft.	10
18	Under flooring 1 by 6 in. SIS2E laid diagonally	M.B.Ft.	13
19	Roof sheathing 1 by 6 in. rough laid straight	M.B.Ft.	13
20	Roof sheathing 1 by 6 in. D & M laid straight	M.B.Ft.	13
21	Floor plank, 2 by 8 in. or 2 by 10 in. SIS2E on joist	M.B.Ft.	7
22	Floor plank, 3 by 10 in. or 3 by 12 in. SIS2E on joist	M.B.Ft.	5
23	Finished floor on under floor 1¾6 by 2¼ in. not scraped	M.B.Ft.	22
24	Finished floor on under floor 1¾6 by 3¼ in. not scraped	M.B.Ft.	20
25	Finished floor on under floor 1¼6 by 3¼ in. not scraped	M.B.Ft.	17
26	Finished floor on sleepers 1¾6 by 2¼ in. not scraped	M.B.Ft.	23
27	Finished floor on sleepers 1¾6 by 3¼ in. not scraped	M.B.Ft.	21
28	Finished floor on sleepers 1¼6 by 3¼ in. not scraped	M.B.Ft.	18
29	Side wall and ceiling sheathing ⅝- by 3¼-in. pine, D & M	M.B.Ft.	20
30	Side wall and ceiling sheathing ⅝- by 5⅛-in. pine D M & B	M.B.Ft.	17
31	Framing and erecting wooden columns or posts	M.B.Ft.	16
32	Framing and erecting heavy wooden beams and girders	M.B.Ft.	8
33	Hand chamfering of wooden posts and framing timber	100 L.F.	2
34	Laying laminated floors, 4 and 6 in. thickness—factory work	M.B.Ft.	12
35	Laying laminated floors, 8 and 10 in. thickness—factory work	M.B.Ft.	10
36	Scraping and sandpapering hardwood floors by hand	100 S.F.	3½
37	Scraping and sandpapering hardwood floors by mch. (rooms 400 S.F. or more)	100 S.F.	1½
38	Placing deadening felt or quilt and furring strips 16 in. centers over under floor	100 S.F.	3
39	Placing deadening felt or quilt and furring strips 12 in. centers over under floor	100 S.F.	4
40	Framing and erect rough door buck for single door without transom	Each	1½
41	Framing and erect rough door buck for double door without transom	Each	2
42	Framing and erect rough door buck for single door with transom	Each	2
43	Framing and erect rough door buck for double door with transom	Each	2½
44	Caulking window frame with oakum	100 L.F.	4½
45	Cutting and installing bridging from 2 by 3 in.	100 Pcs.	5
46	Erecting porch columns, ordinary work	Each	1
47	Erecting porch columns, good work	Each	1½
48	Erecting porch balustrade, ordinary work	100 L.F.	16
49	Erecting porch balustrade, good work	100 L.F.	30
50	Framing and erect plain outside open porch stairs without landing	Flight	14
51	Framing and erect plain outside open porch stairs with landing	Flight	20
52	Erecting diagonal lattice work, ordinary work	100 S.F.	4½
53	Placing wood furring strips on brick or tile walls, ordinary work	100 L.F.	1¾
54	Placing wood furring strips on brick or tile walls, good work	100 L.F.	3
55	Placing wood grounds on brick or tile walls, ordinary work	100 L.F.	2½
56	Placing wood grounds on brick or tile walls, good work	100 L.F.	4
57	Placing wood grounds on frame walls	100 L.F.	2½
58	Placing wood furring strips over rough wood floor, ordinary work	100 L.F.	1¼
59	Placing wood furring strips over rough wood floor, good work	100 L.F.	3½

TABLE II.—LABOR TO INSTALL ROUGH CARPENTRY.—(*Continued*)

No.	Kind of work	Unit	Hours to do unit of work
1	Novelty or drop siding 5½ in. to the weather	100 S.F.	2.1
2	Novelty or drop siding 3¼ in. to the weather	100 S.F.	2.7
3	Clapboards or bevel siding 4¼ in. to the weather	100 S.F.	2.6
4	Clapboards or bevel siding 2½ in. to the weather	100 S.F.	4.1
5	Board and batten siding using 10- to 12-in. boards	100 S.F.	2.3
6	Wall sheathing 1 by 6 in. SIS2E laid straight	100 S.F.	1.4
7	Wall sheathing 1 by 6 in. SIS2E laid diagonally	100 S.F.	1.8
8	Under flooring 1 by 6 in. SIS2E laid straight	100 S.F.	1.1
9	Under flooring 1 by 6 in. SIS2E laid diagonally	100 S.F.	1.5
10	Roof sheathing 1 by 6 in. rough laid straight	100 S.F.	1.4
11	Roof sheathing 1 by 6 in. D & M laid straight	100 S.F.	1.5
12	Floor plank, 2 by 8 or 2 by 10 in. SIS2E on joist	100 S.F.	1.6
13	Floor plank, 3 by 10 in. or 3 by 12 in. SIS2E on joist	100 S.F.	1.7
14	Finished floor on under floor 1 3/16 by 2⅜ in. not scraped	100 S.F.	3.0
15	Finished floor on under floor 1 3/16 by 3¼ in. not scraped	100 S.F.	2.6
16	Finished floor on under floor 1 1/16 by 3¼ in. not scraped	100 S.F.	2.7
17	Finished floor on sleepers 1 3/16 by 2⅜ in. not scraped	100 S.F.	3.1
18	Finished floor on sleepers 1 3/16 by 3¼ in. not scraped	100 S.F.	2.7
19	Finished floor on sleepers 1 1/16 by 3¼ in. not scraped	100 S.F.	2.9
20	Side wall and ceiling sheathing 9/16 by 3¼-in. pine D & M	100 S.F.	2.6
21	Side wall and ceiling sheathing 9/16 by 5½-in. pine D M & B	100 S.F.	2.1

Nails Required for Carpenter Work.—In making up estimates for bidding purposes it is not customary to figure carefully the amount of nails of the different sizes required but rather to estimate roughly the number of kegs or total weight in hundreds of pounds and price them at an average price. The ordinary method consists in adding together all of the lumber required for the job that will be nailed in place, and assuming about ⅓ keg per M.B. ft.

It becomes necessary, however, when one has the contract and is ready to order material, to estimate with a fair degree of accuracy the different kinds of nails needed and the amount of each. By use of the accompanying tables such an estimate can easily be prepared.

Kinds and Quantities of Wire Nails Required for Carpenter Work

Sizes and kinds of material	Nailings	Nails								
		Trade names	Length	Size gage	Number to pound	Pounds per M.B. ft. on centers as follows, inches				
						12	16	20	36	48
1 by 4	2	8d common	2½	10¼	106	62	48	40	24	19
1 by 6	2	8d common	2½	10¼	106	42	32	27	16	18
1 by 8	2	8d common	2½	10¼	106	31	26	20	12	10
1 by 10	2	8d common	2½	10¼	106	25	20	16	10	8
1 by 12	3	8d common	2½	10¼	106	31	24	20	12	10
2 by 4	2	20d common	4	6	31	106	82	65	41	33
2 by 6	2	20d common	4	6	31	71	55	46	27	22
2 by 8	2	20d common	4	6	31	53	41	35	20	16
2 by 10	3	20d common	4	6	31	64	50	42	25	20
2 by 12	3	20d common	4	6	31	53	41	35	20	16
3 by 4	2	60d common	6	2	11	200	155	131	77	62
3 by 6	2	60d common	6	2	11	133	102	87	51	41
3 by 8	2	60d common	6	2	11	100	77	65	39	31
3 by 10	3	60d common	6	2	11	120	93	79	46	37
3 by 12	3	60d common	6	2	11	100	77	65	39	31
Base, per 100 lin. ft.	2	8d finish	2½	12½	189		1			
Byrket lath	2	8d common	2½	10¼	106		48			
Ceiling, ¾ by 4	1	8d finish	2½	12½	189	18	14			
Ceiling, ½ by 5⅝ by 4 in	1	6d finish	2	13	309	11	8			
Finish, ⅞ by 4 in	2	8d finish	2½	12½	189	35	27			
Finish, 1⅛	2	10d finish	3	11½	121	29	22			
Flooring, 1 by 3	1	8d floor brads	2½	10	99	44	34			
Flooring, 1 by 4	1	8d floor brads	2½	10	99	33	25			
Flooring, 1 by 6	1	8d floor brads	2½	10	99	22	17			
Framing, 2 by 4 to 2 by 16.		20d common	4	6	31	20	15	13	8	6
		16d common	3½	8	49	10	8	6½	4	3
		10d common	3	9	69	8	6	5	3	3
Framing, 3 by 4 to 3 by 14.	...	60d common	6	2	11	30	25	20	12	9
Siding, drop, 1 by 4	2	8d casing	2½	11½	145	46	35			
Siding, drop, 1 by 6	2	8d casing	2½	11½	145	30	23			
Siding, drop, 1 by 8	2	8d casing	2½	11½	145	23	18			
Siding, bevel, ½ by 4	1	6d finish	2	13	309	11	8			
Siding, bevel, ½ by 6	1	6d finish	2	13	309	7	5½			
Siding, bevel, ½ by 8	1	6d finish	2	13	309	5½				

KINDS AND QUANTITIES OF WIRE NAILS REQUIRED FOR CARPENTER WORK.—(*Continued*)

Sizes and kinds of material	Nail-ings	Nails				
		Trade names	Length	Size gage	Number to pound	Pounds per square
Ready roofing	2	Barbed wire roofing	⅞	12	469	0.75
Ready roofing	1	Barbed wire roofing	⅞	12	469	1.5
Ready roofing	2	Felt rfg. 5/8-in. head	⅞	12	180	1.5
Ready roofing	1	Felt rfg. 5/8-in. head	⅞	12	180	3.0
Wood shingles, 4 exp	2	3d wire shingle	1¼	13	429	4.5
Wood shingles, 4½ exp	2	3d wire shingle	1¼	13	429	4.1
Wood shingles, 5 exp	2	3d wire shingle	1¼	13	429	3.7
Wood shingles, 5½ exp	2	3d wire shingle	1¼	13	429	3.4
Wood shingles, 7½ exp	2	4d wire shingle	1½	12	274	4 0
Asphalt shingles	2 ea.	Felt rfg. 5/8-in. head	⅞	12	180	5.25
Asphalt shingles	2 ea.	Barbed rfg. ½-in. head	⅞	10	253	3.75
Wall board	2	2d barbed berry	1	16	1,150	0.5
Wall board	3	2d barbed berry	1	16	1,150	0.25
Plaster board	3 ext. 9 int.	3d barbed roofer	1½	10	183	2.25
3/8 by 1½ D. & M. flooring	10	3d wire finish	1¼	15½	807	1.2
3/8 by 2 D. & M. flooring	10	3d wire finish	1¼	15½	807	1.0
3/8 by 2¼ D. & M. flooring	10	3d wire finish	1¼	15½	807	0.8
3/16 by 2 D. & M. flooring	16	8d cut flooring	2½	....	93	5.5
3/16 by 2¼ D. & M. flooring	16	8d cut flooring	2½	....	93	5.0
13/16 by 3¼ D. & M. flooring	16	8d cut flooring	2½	....	93	3.5
1 1/16 by 2 D. & M. flooring	16	10d cut flooring	3	....	63	8.0
1 1/16 by 2¼ D. & M. flooring	16	10d cut flooring	3	....	63	7.0
1 1/16 by 3¼ D. &M. flooring	16	10d cut flooring	3	....	63	5.0
Casing, per opening	..	6d and 8d casing	...	....	.....	0.5 per side

Wire Nails

Size, length, and approximate number per pound

Size		Common nails and brads	Spikes	Fencing	Casing and box	Finishing	Flooring brads	Clinch	Shingle	Barbed roofing	Large head roofing		
Penny	Length, inches										Gage		
											No. 8	No. 9	No. 10
	¾	...	....	...	.....	.....	...	...	...	714	205	252	290
	⅞	...	....	...	....	.....	..	...	...	469	179	219	253
2d	1	876	....	...	1,010	1,351	...	710	...	411	158	193	224
	1⅛	...	....	...	...	...	...	...	...	365	142	173	201
3d	1¼	568	....	...	635	807	...	429	429	251	128	156	183
4d	1½	316	....	...	473	584	...	274	274	176	108	131	154
5d	1¾	271	....	142	406	500	...	235	235	151	93	113	133
6d	2	181	....	124	236	309	157	157	204	103			
7d	2¼	161	....	92	210	238	139	139					
8d	2½	106	....	82	145	189	99	99					
9d	2¾	96	....	62	132	172	90	90					
10d	3	69	41	50	94	121	69	69					
12d	3¼	63	38	40	87	113	54	62					
16d	3½	49	30	30	71	90	43	49					
20d	4	31	23	23	52	62	31	37					
30d	4½	24	17	...	46								
40d	5	18	13	...	35								
50d	5½	14	10										
60d	6	11	9										
	7	...	7										
	8	...	4										
	9	...	3½										
	10	...	3										
	12	...	2½										

CUT STEEL NAILS

Size, length, and approximate number per pound

Size		Common	Flooring	Fine finishing	New York finishing	Clinch	Casing and box	Fence	Spikes
Penny	Length, inches								
2d	1	740	...	1,100	869	400			
3d	1¼	460	...	900	711	260			
4d	1½	280	...	600	474	180	420		
5d	1¾	210	216	350	276	125	300	100	
6d	2	160	165	300	237	100	210	80	
7d	2¼	120	129	220	174	80	180	60	
8d	2½	88	93	178	140	68	130	52	
9d	2¾	72	72	160	126	52	107	38	
10d	3	60	63	150	118	48	88	26	
12d	3¼	46	50	140	110	40	70	20	
16d	3½	33	36	110	86	31	52	18	17
20d	4	22	27	90	71	24	38	16	14
30d	4½	16½	...	.....	...	...	...	...	11
40d	5	12	...	.....	...	...	...	...	9
50d	5½	10	...	.....	...	..	...	...	7½
60d	6	8	...	.....	...	...	...	...	6
70d	6½	7½	...	.....	...	...	...	...	5½
80d	7	7	...	.....	...	...	...	...	5
90d	7½	5							
100d	8	6							

Wire Staples.—Metal lath staples are furnished in standard sizes of 1, 1⅛, 1¼ and 1½ in. They are made of No. 14 gage wire. The 1-in. length is used most. They are finished blued, polished, or galvanized.

Poultry netting staples are made of No. 14 galvanized wire and are of three sizes: ¾-in. run 480, ⅞ in. 416 and 1 in. 352 to the pound.

Fence staples are either annealed, polished, or galvanized and of gages 8, 9, 10, 11, 12 and 13. When made of No. 9 wire the approximate number per pound is as follows: ¾ in. 152, ⅞ in. 120, 1 in. 108, 1⅛ in. 96, 1¼ in. 87, 1½ in. 72, 1¾ in. 65, 2 in. 58, 2¼ in. 47 and 2½ in. 40.

The Proper Nails to Use for Hardwood Flooring[1]

It is very essential that the proper nails be used in laying hardwood flooring to prevent splitting the tongue and bruising the face. For the best results the following are recommended: Threepenny finishing nails for $\frac{3}{8}$ in. thick, used 9 in. apart. Eightpenny cut flooring nails for $1\frac{3}{16}$ in. thick, used 16 in. apart. Tenpenny cut flooring nails for $1\frac{1}{16}$ in. thick, used 16 in. apart.

The threepenny is a wire nail and on account of the small gage and medium length is best adapted to thin flooring.

The eightpenny and tenpenny are steel-cut nails, manufactured especially for laying hardwood flooring and are being used by up-to-date contractors and floor-layers. These nails are the same thickness from point to head and have two smooth sides which are set parallel with the tongue, eliminating the strain from the narrow part of the tongue. They are wedged-shape in width, which puts the entire strain lengthwise of the tongue. The rough edges give these nails drawing and holding qualities not contained in any other nail, and after being driven their entire length they remain in position, producing and maintaining a perfectly tight joint.

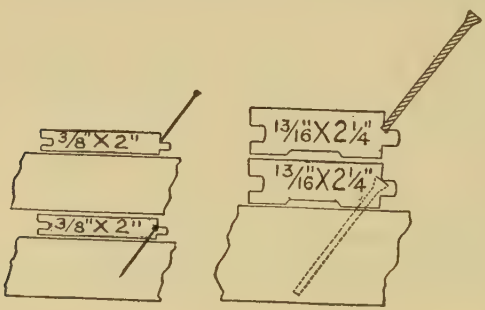


Fig. 2.

The nails should be driven at an angle of 45 to 55 deg., and the first nail or two driven in the piece of flooring should be "toe-nailed" toward the preceding piece to which it joins.

Figure 2 shows the threepenny finishing nail in the position it should be held in starting, and the same nail after being driven its

[1] Maple Flooring Manufacturers Association, Chicago, Ill.

entire length and set. It also shows the eightpenny cut flooring nail in the position it should be held in starting, and the same nail after being driven its entire length and set.

TELEGRAPH POLES

Data concerning telephone and telegraph poles

Length of pole, feet	Diameter 6 in. from butt, inches	Diameter at top, inches	Depth pole should be placed in ground, feet
25	9 to 10	6 to 8	5
30	9 to 11	6 to 8	5½
35	9 to 12	6 to 8	5½
40	9 to 13	6 to 8	6
45	9 to 14	6 to 8	6½
50	9 to 15	6 to 8	7
55	16 to 17	6 to 8	7½
60	16 to 18	6 to 8	7½
65	16 to 19	6 to 8	8
70	16 to 20	6 to 8	8
75	16 to 21	6 to 8	8½
80	16 to 22	6 to 8	9

SIZES AND WEIGHTS OF WHITE CEDAR POLES

Length, feet	Top diameter, inches	Weight, pounds	Length, feet	Top diameter, inches	Weight, pounds
20	4	100	45	6	900
20	5	130	45	7	1,100
20	6	190	45	8	1,350
25	4	150	50	6	1,150
25	5	200	50	7	1,350
25	6	250	50	8	1,700
25	7	350	55	6	1,350
30	5	275	55	7	1,700
30	6	350	55	8	2,200
30	7	450	60	6	1,700
30	8	575	60	7	2,200
35	5	375	60	8	2,500
35	6	450	65	6	2,200
35	7	600	65	7	2,500
35	8	850	65	8	3,000
40	6	625	70	6	2,500
40	7	850	70	7	3,000
40	8	1,100	70	8	4,000

POLE STEPS

Sizes, inches	Approximate weight of 100 pole steps	
	Plain, pounds	Galvanized, pounds
8 by $\frac{5}{8}$	73	75
9 by $\frac{5}{8}$	78	81
10 by $\frac{5}{8}$	85	88
$10\frac{1}{2}$ by $\frac{5}{8}$	89	93
$8\frac{1}{2}$ by $\frac{9}{16}$	58	61
9 by $\frac{9}{16}$	62	65
$10\frac{1}{2}$ by $\frac{9}{16}$	71	74
9 by $\frac{1}{2}$	51	54

Lengths given are measurement over all.
A keg of pole steps weighs about 200 lb.

A VISUAL METHOD OF DISTINGUISHING LONGLEAF FROM SHORTLEAF AND LOBLOLLY PINE

In the examination of specimens of wood from the southern pines at the U. S. Forest Products Laboratory, a distinct difference was noted in the size of the pith of longleaf pine and that of shortleaf and loblolly pine. This difference suggested an easy method of distinguishing the pines, which would be particularly useful to the lumberman because it did not require a microscope. Obviously, this method can be used only on ties and timbers cut from the center of the tree; but it is, as a rule, only regarding large pieces that the lumberman or contractor desires to know the exact species.

The pith, or small, dark, soft, core at the center of the tree, averages larger in longleaf than in shortleaf or loblolly pine. In longleaf the pith is over 0.1 in. in diameter; in the other two species it is smaller, usually about the size of the lead in a pencil, except in trees of very vigorous growth, in which it may be as large as in longleaf. The vigor of a tree at the time the pith was formed is indicated by the diameter of the second annual ring. Therefore, where the pith in loblolly and shortleaf is over 0.1 in. in diameter, the diameter of the second annual ring is comparatively large; in fact, it is larger than in longleaf having the same sized pith.

HOW TO USE THE PITH AND SECOND ANNUAL RING FOR IDENTIFICATION

1. With a sharp knife carefully smooth the end surface of the pith and surrounding wood. If the pith or second annual ring is not clear, moisten the smoothed surface. If knots are present near the pith, satisfactory measurements cannot be made, and the other end of the timber should be inspected.

2. If the pith is about the size of the lead in the ordinary lead pencil or smaller, the specimen is not longleaf, and no further measurement is necessary.

3. If the pith is plainly over 0.1 in. in diameter and the growth rings surrounding it very narrow, the specimen is longleaf.

4. If in doubt as to the species, carefully measure the average diameter of the pith, not including small projections, using a rule graduated in twenty-fifths or fiftieths of an inch. A reading glass or

Specific Gravity and Average Weights of Various Species of Woods Grown in the United States

(U. S. Forest Products Laboratory)

In making the weight determinations given in the following table, the United States Forest Products Laboratory used small, clear specimens secured from the top 4 ft. of the 16-ft. butt logs of typical trees. Wood thus selected probably averages a trifle heavier than the wood in ordinary ties, structural timbers, poles, and posts. Such large pieces usually include the pith, or are taken from top logs where relatively light weight material is frequently encountered.

Common name	Botanical name	Locality where grown	Specific gravity based on oven-dry weight and		Weights, pounds per cubic foot		
			Volume green	Volume oven-dry	Green[1]	Air-dry	Kiln-dry
		Hardwoods					
Ash, white	*Fraxinus americana*	Ark., W. Va.	0.52	0.60	46	40	39
Ash, white (second growth)	*Fraxinus americana*	N. Y.	0.58	0.71	51	46	44
Aspen	*Populus tremuloides*	Wis.	0.36	0.42	47	27	26
Basswood	*Tilia americana*	Penn., Wis.	0.33	0.40	41	26	25
Beech	*Fagus atropunicea*	Ind., Penn.	0.54	0.66	55	44	42
Birch, paper	*Betula papyrifera*	Wis.	0.47	0.60	51	38	37
Birch, yellow	*Betula lutea*	Penn., Wis.	0.54	0.66	58	45	43
Buckeye, yellow	*Aesculus octandra*	Tenn.	0.33	0.38	49	25	24
Butternut	*Juglans cinerea*	Tenn., Wis.	0.36	0.40	46	27	26
Cherry, wild red	*Prunus pennsylvanica*	Tenn.	0.36	0.42	33	28	27

Chestnut	*Castanea dentata*	Md., Tenn.	0.40	0.46	55	30	29
Cottonwood	*Populus deltoides*	Mo.	0.37	0.43	49	29	28
Cottonwood, black	*Populus trichocarpa*	Wash.	0.32	0.37	46	24	23
Cucumber tree	*Magnolia acuminata*	Tenn.	0.44	0.52	50	34	33
Dogwood, flowering	*Cornus florida*	Tenn.	0.64	0.80	65	54	52
Elm, cork	*Ulmus racemosa*	Wis.	0.58	0.66	54	45	44
Elm, slippery	*Ulmus pubescens*	Ind., Wis.	0.48	0.56	56	38	37
Elm, white	*Ulmus americana*	Wis., Penn.	0.44	0.54	52	34	33
Gum, black	*Nyssa sylvatica*	Tenn.	0.46	0.55	45	36	35
Gum, red	*Liquidambar styraciflua*	Mo.	0.44	0.53	50	35	34
Hackberry	*Celtis occidentalis*	Ind., Wis.	0.48	0.56	50	38	37
Hickory, big shellbark	*Hicoria laciniosa*	Miss., O.	0.62	....	63	52	50
Hickory, mockernut	*Hicoria alba*	W. Va., Miss., Penn.	0.64	....	64	52	51
Hickory, pecan	*Hicoria pecan*	Mo.	0.60	0.69	61	47	45
Hickory, shagbark	*Hicoria ovata*	O., Miss., Penn., W. Va.	0.64	....	64	52	50
Ironwood, black	*Rhamnidium ferreum*	Fla.	1.05	....	86	80	77
Locust, honey	*Gleditsia triacanthos*	Mo., Ind.	0.60	0.67	61	45	43
Maple, broadleaf	*Acer macrophyllum*	Wash.	0.44	0.51	57	34	32
Maple, red	*Acer rubrum*	Wis., Penn.	0.48	0.54	51	37	36
Maple, silver	*Acer saccharinum*	Wis.	0.44	0.51	46	34	32
Maple, sugar	*Acer saccharum*	Ind., Penn., Wis.	0.56	0.66	56	44	43
Oak, bur	*Quercus macrocarpa*	Wis.	0.58	0.67	61	45	43
Oak, chestnut	*Quercus prinus*	Tenn.	0.57	0.67	62	46	45
Oak, live	*Quercus virginiana*	Fla.	0.81	0.98	76	64	62
Oak, post	*Quercus minor*	Ark., La.	0.60	0.74	63	48	46
Oak, red	*Quercus rubra*	Ark., La., Ind., Tenn.	0.56	0.65	64	44	42
Oak, swamp white	*Quercus platanoides*	Ind.	0.64	0.79	69	52	50
Oak, water	*Quercus nigra*	La.	0.56	0.68	63	45	43
Oak, white	*Quercus alba*	Ark., La., Ind.	0.60	0.71	62	48	46
Osage-orange	*Toxylon pomiferum*	Ind.	0.76	0.84	62	56	54
Persimmon	*Diospyros virginiana*	Mo.	0.64	0.78	63	53	51
Poplar, yellow	*Liriodendron tulipifera*	Tenn.	0.37	0.42	38	28	27
Rhododendron, great	*Rhododendron Maximum*	Tenn.	0.50	0.60	62	40	39
Sassfras	*Sassafras sassafras*	Tenn.	0.42	0.47	44	32	31
Sumac, staghorn	*Rhus hirta*	Wis.	0.45	....	41	34	32
Sycamore	*Platanus occidentalis*	Ind., Tenn	0.46	0.54	52	36	35
Walnut, black	*Juglans nigra*	Ky.	0.51	0.56	58	39	38
Willow, black	*Salix nigra*	Wis., Mo.	0.34	0.41	50	27	26
Witch hazel	*Hamamelis virginiana*	Tenn.	0.56	0.71	59	46	45

[1] Average green material.

SPECIFIC GRAVITY AND AVERAGE WEIGHTS OF VARIOUS SPECIES OF WOODS GROWN IN THE UNITED STATES.—(*Continued*)

(U. S. Forest Products Laboratory)

Common name	Botanical name	Locality where grown	Specific gravity based on oven-dry weight and		Weights, pounds per cubic foot		
			Volume green	Volume oven-dry	Green[1]	Air-dry[2]	Kiln-dry[3]
		CONIFERS					
Cedar, western red	*Thuja plicata*	Wash., Mont.	0.31	0.34	27	23	22
Cedar, northern white	*Thuja occidentalis*	Wis.	0.29	0.32	28	21	20
Cypress, bald	*Taxodium distichum*	La., Mo.	0.41	0.47	48	31	30
Douglas fir	*Pseudotsuga taxifolia*	Wash., Ore.	0.45	0.52	38	35	34
Douglas fir	*Pseudotsuga taxifolia*	Mont., Wyo.	0.40	0.44	34	31	29
Fir, balsam	*Abies balsamea*	Wis.	0.34	0.41	45	25	24
Fir, noble	*Abies nobilis*	Ore.	0.35	0.41	31	27	26
Fir, red	*Abies magnifica*	Cal.	0.37	0.42	48	28	27
Fir, white	*Abies concolor*	Cal.	0.35	0.39	56	26	25
Hemlock, eastern	*Tsuga canadensis*	Tenn., Wis.	0.38	0.44	48	29	28
Hemlock, western	*Tsuga heterophylla*	Wash.	0.38	0.43	41	29	28
Juniper, alligator	*Juniperus pachyphyloea*	Ariz	0.48	0.54	42	35	34
Larch, western	*Larix occidentalis*	Mont., Wash.	0.48	0.59	48	37	36
Pine, jack	*Pinus divaricata*	Wis.	0.39	0.46	50	30	29
Pine, Jeffrey	*Pinus jeffreyi*	Cal.	0.37	0.42	47	28	27
Pine, limber	*Pinus flexilis*	N. Mex.	0.37	0.42	39	28	26
Pine, loblolly	*Pinus taeda*	Fla., N. C., S. C.	0.50	0.59	54	39	37
Pine, lodgepole	*Pinus contorta*	Colo., Mont., Wyo.	0.38	0.44	39	29	28
Pine, longleaf	*Pinus palustris*	Fla., La., Miss.	0.55	0.64	50	42	41
Pine, Norway	*Pinus resinosa*	Wis.	0.44	0.51	42	34	32
Pine, pitch	*Pinus rigida*	Tenn.	0.47	0.54	54	36	35

Pine, pond	*Pinus serotina*	Fla.	0.50	0.58	49	38	37
Pine, sand	*Pinus clausa*	Fla.	0.45	0.51	38	34	33
Pine, shortleaf	*Pinus echinata*	Ark., La.	0.50	0.58	50	39	37
Pine, slash	*Pinus heterophylla*	Fla.	0.58	0.68	53	45	43
Pine, sugar	*Pinus lambertiana*	Cal.	0.36	0.39	50	27	26
Pine, table mountain	*Pinus pungens*	Tenn.	0.49	0.55	54	37	36
Pine, western white	*Pinus monticola*	Mont.	0.39	0.45	39	30	29
Pine, western yellow	*Pinus ponderosa*	Colo., Mont., Ariz., Wash., Cal.	0.38	0.42	46	29	28
Pine, white	*Pinus strobus*	Wis.	0.36	0.39	39	27	26
Redwood	*Sequoia sempervirens*	Cal.	0.41	0.44	55	30	28
Spruce, Engelmann	*Picea engelmanni*	Colo.	0.31	0.35	38	24	23
Spruce, red	*Picea rubens*	N. H., Tenn.	0.38	0.41	34	29	28
Spruce, Sitka	*Picea sitchensis*	Wash.	0.34	0.37	33	26	25
Spruce, white	*Picea canadensis*	N. H., Wis.	0.36	0.43	33	29	27
Tamarack	*Larax laricina*	Wis.	0.49	0.56	47	38	37

[1] Average green material.

[2] About 12 or 15 per cent moisture—average condition reached without artificial heating by material sheltered from precipitation—North Central States.

[3] About 8 per cent moisture.

Any individual lot of lumber in the condition specified in the column headings would probably vary 5 per cent from the figures given with a possible variation of as much as 20 per cent. For example, young thrifty pines will have a high moisture content when freshly cut and will probably weigh 20 per cent above the average given.

other small lens is helpful but not essential in making these measurements. Then measure the diameter of the second annual ring in tenths of an inch. The first and second rings are usually very distinct, but in some pieces the first annual ring is rather faint, and care must be taken not to mistake the third annual ring for the second. Sometimes false rings are present, but these can always be recognized

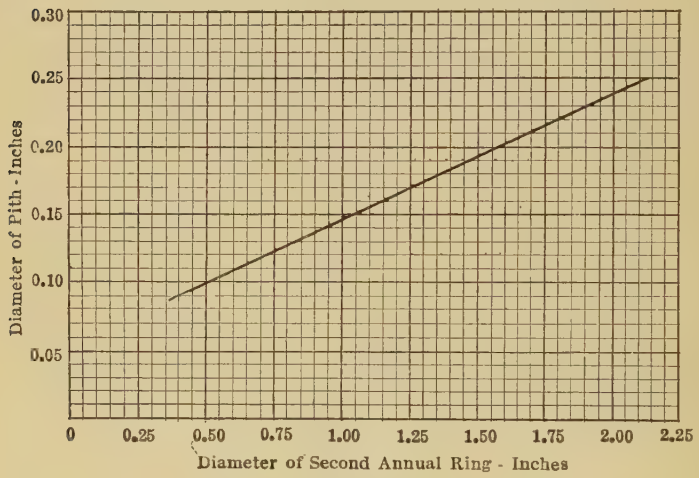


FIG. 3.

by the fact that they are not prominent all the way around, and their outer limit is not defined by a sharp line.

5. On the diagram find the point where the vertical line which indicates the diameter of the pith intersects the horizontal line which indicates the diameter of the second annual ring.

6. If the point of intersection falls above the diagonal line in the diagram, the specimen is longleaf, or in rare instances slash or pond pine. If it falls below the line, the specimen is not longleaf, but is shortleaf, loblolly, or some other of the minor southern pines.

Wood Beams

(Safe loads uniformly distributed, in tons, fiber stress 1,250 lb. per square inch)

Span in feet	6 in. deep, breadth			8 in. deep, breadth					10 in. deep, breadth							12 in. deep, breadth							
	2 in.	3 in.	4 in.	2 in.	3 in.	4 in.	5 in.	6 in.	2 in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	2 in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.
6	0.83	1.25	1.67	1.48	2.22	2.96	3.71	4.45	2.31	3.47	4.63	5.79	6.74	8.10	9.26	3.33	5.00	6.67	8.33	10.00	11.67	13.34	15.00
7	0.71	1.07	1.43	1.27	1.91	2.54	3.18	3.81	1.98	2.98	3.97	4.96	5.95	6.74	7.94	2.86	4.29	5.72	7.15	8.56	10.00	11.43	10.86
8	0.62	0.94	1.25	1.10	1.67	2.22	2.78	3.33	1.74	2.60	3.47	4.34	5.21	6.08	6.94	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25
9	0.56	0.83	1.11	0.99	1.48	1.98	2.47	2.96	1.54	2.32	3.09	3.86	4.63	5.40	6.18	2.22	3.33	4.44	5.56	6.67	7.78	8.89	10.00
10	0.50	0.75	1.00	0.89	1.33	1.78	2.22	2.66	1.40	2.08	2.80	3.47	4.16	4.66	4.59	2.00	3.00	4.00	5.00	6.00	7.00	8 00	9.00
11	0.45	0.68	0.91	0.81	1.21	1.61	2.02	2.42	1.26	1.89	2.52	3.16	3.79	4.42	5.05	1.82	2.73	3.64	4.55	5.45	6.36	7.27	8.18
12	0.42	0.62	0.83	0.74	1.11	1.48	1.85	2.22	1.16	1.74	2.32	2.90	3.47	4.05	4.63	1.67	2.50	3.33	4.17	5.00	5.83	6.67	7.50
13	0.38	0.58	0.77	0.68	1.03	1.37	1.72	2.05	1.07	1.60	2.14	2.67	3.20	3.74	4.27	1.54	2.31	3.08	3.85	4.61	5.38	6.15	6.92
14	0.36	0.54	0.72	0.63	0.95	1.26	1.59	1.90	0.99	1.49	1.98	2.48	2.98	3.47	3.97	1.43	2.14	2.86	3.57	4.28	5.00	5.71	6.43
15	0.33	0.51	0.67	0.59	0.89	1.18	1.48	1.78	0.93	1.39	1.85	2.32	2.78	3.24	3.70	1.33	2.00	2.67	3.34	4.00	4.67	5.34	6.00
16	0.31	0.47	0.62	0.56	0.83	1.11	1.39	1.67	0.87	1.30	1.74	2.17	2.60	3.04	3.47	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63
17	0.29	0.44	0.59	0.52	0.78	1.04	1.31	1.57	0.82	1.22	1.63	2.04	2.45	2.86	3.26	1.18	1.76	2.35	2.94	3.53	4.12	4.70	5.29
18	0.28	0.42	0.56	0.49	0.74	0.99	1.24	1.48	0.77	1.16	1.54	1.93	2.31	2.70	3.09	1.11	1.69	2.22	2.78	3.33	3.89	4.45	5.00
19	0.26	0.40	0.53	0.47	0.70	0.94	1.17	1.40	0.73	1.10	1.46	1.83	2.19	2.56	2.92	1.05	1.58	2.10	2.63	3.16	3.67	4.21	4.73
20	0.25	0.38	0.50	0.44	0.67	0.89	1.11	1.33	0.69	1.04	1.39	1.74	2.08	2.43	2.78	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
21	0.24	0.36	0.48	0.42	0.64	0.85	1.06	1.27	0.66	0.99	1.32	1.67	1.99	2.32	2.65	0.95	1.43	1.90	2.38	2.86	3.33	3.81	4.28
22	0.23	0.34	0.46	0.40	0.61	0.81	1.01	1.21	0.62	0.93	1.24	1.56	1.87	2.18	2.49	0.91	1.37	1.82	2.28	2.73	3.19	3.64	4.10
23	0.22	0.33	0.44	0.39	0.58	0.77	0.97	1.16	0.60	0.91	1.21	1.51	1.81	2.11	2.42	0.87	1.31	1.74	2.18	2.61	3.05	3.48	3.92
24	0.21	0.31	0.42	0.37	0.56	0.74	0.93	1.11	0.58	0.87	1.16	1.45	1.73	2.02	2.31	0.83	1.25	1.67	2.09	2.50	2.92	3.34	3.75
25	0.20	0.30	0.40	0.36	0.53	0.71	0.89	1.07	0.56	0.83	1.11	1.39	1.67	1.95	2.22	0.80	1.20	1.60	2.00	2.40	2.80	3.20	3.60
26	0.19	0.29	0.38	0.34	0.51	0.69	0.86	1.03	0.53	0.80	1.07	1.34	1.60	1.87	2.14	0.77	1.16	1.54	1.93	2.31	2.70	3.08	3.47
27	....	....	....	0.33	0.50	0.66	0.83	0.99	0.51	0.77	1.03	1.29	1.54	1.80	2.06	0.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33
28	....	....	....	0.32	0.48	0.64	0.80	0.95	0.50	0.74	0.99	1.24	1.49	1.74	1.98	0.71	1.07	1.43	1.79	2.14	2.50	2.86	3.21
29	....	....	....	....	....	....	....	....	0.48	0.72	0.96	1.20	1.43	1.67	1.91	0.69	1.04	1.38	1.73	2.07	2.42	2.76	3.11
30	....	....	....	....	....	....	....	....	0.46	0.69	0.92	1.16	1.39	1.62	1.85	0.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00

Wood Beams.—(*Continued*)

(Safe loads uniformly distributed, in tons, fiber stress 1,250 lb. per square inch)

Span in feet	14 in. deep, breadth						16 in. deep, breadth						
	2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	12 in.
6	4.54	6.81	9.08	13.61	18.15	22.69	5.93	8.89	11.86	17.78	23.71	29.64	35.57
7	3.89	5.83	7.78	11.66	15.55	19.44	5.07	7.61	10.14	15.21	20.28	25.35	30.42
8	3.40	5.10	6.80	10.21	13.61	17.01	4.45	6.68	8.90	13.35	17.80	22.25	26.70
9	3.02	4.54	6.05	9.07	12.10	15.12	3.94	5.92	7.88	11.84	15.76	19.74	23.69
10	2.72	4.08	5.44	8.17	10.89	13.61	3.55	5.32	7.09	10.64	14.18	17.73	21.28
11	2.47	3.71	5.15	7.42	10.30	12.37	3.24	4.85	6.47	9.71	12.94	16.18	19.42
12	2.27	3.40	4.54	6.80	9.07	11.34	2.96	4.44	5.92	8.88	11.84	14.80	17.76
13	2.09	3.14	4.19	6.28	8.38	10.47	2.73	4.10	5.47	8.20	10.94	13.67	16.40
14	1.99	2.92	3.89	5.83	7.78	9.72	2.54	3.82	5.09	7.63	10.18	12.72	15.26
15	1.81	2.72	3.63	5.44	7.26	9.07	2.38	3.56	4.75	7.12	9.50	11.87	14.24
16	1.70	2.55	3.40	5.11	6.81	8.51	2.23	3.34	4.45	6.68	8.90	11.13	13.36
17	1.60	2.40	3.20	4.81	6.42	8.01	2.11	3.17	4.21	6.35	8.42	10.58	12.70
18	1.51	2.27	3.02	4.54	6.05	7.56	1.98	2.97	3.96	5.94	7.92	9.90	11.88
19	1.43	2.15	2.86	4.30	5.73	7.16	1.88	2.82	3.76	5.63	7.51	9.39	11.27
20	1.36	2.04	2.72	4.09	5.45	6.81	1.79	2.68	3.58	5.36	7.15	8.94	10.73
21	1.30	1.94	2.59	3.89	5.18	6.48	1.70	2.55	3.40	5.10	6.80	8.50	10.20
22	1.24	1.86	2.48	3.71	4.95	6.19	1.63	2.43	3.26	4.86	6.52	8.10	9.72
23	1.18	1.78	2.37	3.55	4.74	5.92	1.55	2.33	3.10	4.65	6.20	7.75	9.30
24	1.13	1.70	2.27	3.40	4.54	5.67	1.49	2.23	2.97	4.46	5.94	7.43	8.92
25	1.09	1.63	2.18	3.26	4.35	5.44	1.43	2.15	2.86	4.29	5.72	7.15	8.58
26	1.05	1.57	2.10	3.14	4.19	5.24	1.37	2.10	2.74	4.11	5.48	6.85	8.22
27	1.01	1.51	2.02	3.02	4.03	5.04	1.32	1.98	2.69	3.96	5.28	6.60	7.92
28	0.97	1.46	1.94	2.92	3.89	4.86	1.28	1.92	2.56	3.84	5.12	6.40	7.68
29	0.94	1.41	1.88	2.81	3.75	4.69	1.24	1.86	2.48	3.72	4.96	6.20	7.44
30	0.91	1.36	1.82	2.72	3.63	4.54	1.20	1.80	2.40	3.60	4.80	6.00	7.20

STRUCTURAL TIMBER[1]

The strength of structural timbers depends upon a number of factors; the kind of wood, the age of the tree, the time of the year in which it was felled, the method of sawing, the character of the seasoning and therewith its moisture content, the proportion of heartwood to sapwood and the proportion of knots to clear wood.

In consequence of these variable factors, the working unit stresses approved by the building laws of different cities vary widely, as well also as the unit stresses given in the proceedings of the various engineering associations. They go back in some cases to the studies made in 1895 by the Association of Railway Superintendents of Bridges and Buildings.

The most recent studies in this direction have been made by the American Railway Engineering Association, and the tables for wooden beams and columns which follow are based on the working unit stresses for structural timbers adopted by that Association. The table of working unit stresses has been reprinted, by permission, from the manual, edition of 1911.

These unit stresses vary with the class of construction. They are intended, as noted, for railway bridges and trestles. For highway bridges and trestles and for buildings and similar structures, the unit stresses may be increased in accordance with the more quiescent character of the loading and freedom from deleterious weather conditions. The values are based on carefully selected timber purchased in accordance with the standard specifications of the Association and subject to careful inspection.

The commercial timbers which are in common use in building construction will not meet these specifications, and, therefore, the unit stresses approved by good building practice as evidenced in the building laws of various cities are rightly lower. The tables as they stand are in accord with the average practice as represented by these building laws, and may, therefore, be used as they stand for ordinary building work executed with the commercial grades of timber, such as can be purchased in the open market.

The allowable loads may be adjusted to other species of wood than those stated in the headings of the tables and to other unit stresses by the direct proportion which such unit stresses bear to those for which the tables are computed. In the case of columns the values may be adjusted to any working unit stress by direct proportion based on the relations of l/d.

WOODEN COLUMNS

The safe load tables of wooden columns which follow, based upon the working unit stresses adopted by the American Railway Engineering Association, give the allowable direct compressive loads for square and round columns.

The safe loads of rectangular columns may be found from the safe loads of square columns by direct proportion of areas, using the safe load unit stress of the square column whose side is equal to the least side of the rectangular section.

[1] Carnegie Steel Company Pocket Companion, 22d Edition.

The following table gives the safe load in pounds per square inch of sectional area for ratios of

$$l/d = \frac{\text{effective length of column, in inches}}{\text{least side or diameter, in inches}},$$

ranging between limits of 15 and 30.

UNIT WORKING STRESSES IN POUNDS PER SQUARE INCH

l/d	Longleaf pine, white oak	Douglas fir, western hemlock	Shortleaf pine, spruce, bald cypress	White pine, tamarack	Red cedar, redwood	Norway pine
	$1{,}300(1 - l/d60)$	$1{,}200(1 - l/d60)$	$1{,}100(1 - l/d60)$	$1{,}000(1 - l/d60)$	$900(1 - l/d60)$	$800(1 - l/d60)$
15	975	900	825	750	675	600
16	953	880	807	733	660	587
17	931	860	788	717	645	573
18	910	840	770	700	630	560
19	888	820	752	683	615	547
20	867	800	733	667	600	533
21	845	780	715	650	585	520
22	823	760	697	633	570	507
23	802	740	678	617	555	493
24	780	720	660	600	540	480
25	758	700	642	583	525	467
26	737	680	623	567	510	553
27	715	660	605	550	495	440
28	693	640	587	533	480	427
29	672	620	568	517	465	413
30	650	600	550	500	450	400

EXAMPLE 1.—Required the allowable load for a column of white oak 10 by 8 in., 14 ft. long.

The safe load given in the table for a square white oak column 8 by 8 in., 14 ft. long, is 54,100 lb. The load for the 10- by 8-in. section is 10 by $54{,}100 \div 8 = 67{,}600$ lb.

EXAMPLE 2.—Required the allowable load for a spruce pile, 9-in. diameter and 18 ft. long.

The unit stress given in the above table for the corresponding ratio of l/d, $18 \times 12 \div 9 = 24$ is 660 lb., and the sectional area for a 9-in. round is 63.62 sq. in. The safe load, therefore, is 63.62 by $660 = 42{,}000$ lb.

SQUARE WOODEN COLUMNS

Safe Loads in Thousands of Pounds

(American Railway Engineering Association Formulas)

	Length, ft.	Side of square, in.								
		4	6	8	10	12	14	16	18	20
Longleaf pine, white oak 1,300 (1 − l/60d)	5	15.6 / 15.6								
	6	14.6								
	7	13.5	35.1 / 34.3							
	8	12.5	32.8	62.4 / 62.4						
	9	11.4	31.2	60.3						
	10	10.4	29.6	58.2	97.5 / 93.6					
	11	....	28.1	54.1	88.4	140.4 / 137.3				
	12	....	25.0	49.9	83.2	131.0	191.1 / 189.3			
	14	....	....	45.8	78.0	124.8	182.0	249.6 / 249.6		
	16	....	....	41.6	72.0	115.2	168.0	230.4	315.9	390.0
	18	....	....	....	66.0	105.6	154.0	211.2	291.6	360.0
	20	....	....	....	60.0	96.0	140.0	192.0	267.3	330.0
Douglas fir, western hemlock 1,200 (1 − l/60d)	5	14.4 / 14.4								
	6	13.4								
	7	12.5	32.4 / 31.7							
	8	11.5	30.2	57.6 / 57.6						
	9	10.6	28.8	55.7						
	10	9.6	27.4	53.8	90.0 / 86.4					
	11	....	25.9	49.9	81.6	129.6 / 126.7				
	12	....	23.0	46.1	76.8	121.0	176.4 / 174.7			
	14	....	....	42.2	72.0	115.2	168.0	230.4 / 230.4		
	16	....	....	38.4	67.2	107.5	156.8	215.0	291.6	360.0
	18	....	....	....	62.4	99.8	145.6	199.6	270.8	334.8
	20	....	....	....	57.6	92.2	134.4	184.3	250.0	309.1
Shortleaf pine, spruce 1,100(1 − l/60d)	5	13.2 / 13.2								
	6	12.3								
	7	11.4	29.7 / 29.0							
	8	10.6	27.7	52.8 / 52.8						
	9	9.7	26.4	51.0						
	10	8.8	25.1	49.3	82.5 / 79.2					
	11	....	23.8	45.8	74.8	118.8 / 116.2				
	12	....	21.1	42.2	70.4	110.9	161.7 / 160.2			
	14	....	....	38.7	66.0	105.6	154.0	211.2 / 211.2		
	16	....	....	35.2	61.6	98.5	143.8	197.1	267.3	330.0
	18	....	....	....	57.2	91.5	133.5	183.0	248.4	307.0
	20	....	....	....	52.8	84.5	123.2	169.0	229.2	283.5
White pine, tamarack 1,000(1 − l/60d)	5	12.0 / 12.0								
	6	11.2								
	7	10.4	27.0 / 26.4							
	8	9.6	25.2	48.0 / 48.0						
	9	8.8	24.0	46.4						
	10	8.0	22.8	44.8	75.0 / 72.0					
	11	....	21.6	41.6	68.0	108.0 / 105.6				
	12	....	19.2	38.4	64.0	100.8	147.0 / 145.6			
	14	....	....	35.2	60.0	96.0	140.0	192.0 / 192.0		
	16	....	....	32.0	56.0	89.6	130.7	179.2	243.0	300.0
	18	....	....	....	52.0	83.2	121.3	166.4	225.7	279.0
	20	....	....	....	48.0	76.8	112.0	153.6	208.3	257.5

Loads in small figures above horizontal lines are the maximum allowable safe loads.

ROUND WOODEN COLUMNS

SAFE LOADS IN THOUSANDS OF POUNDS

(American Railway Engineering Association formulas)

	Length, ft.	Diameter, in.								
		4	6	8	10	12	14	16	18	20
Long leaf pine, white oak 1,300 $(1-l/60d)$	5	12.3								
	6	11.4								
	7	10.6	27.6							
	8	9.8	27.0							
	9	9.0	25.7	49.0						
	10	8.2	24.5	49.0						
	11	....	23.3	47.4						
	12	....	22.1	45.7	76.6					
	14	....	19.6	42.5	73.5	110.3				
	16	....	....	39.2	69.4	107.8	150.1			
	18	....	....	35.9	65.3	102.9	148.7	196.0		
	20	....	....	32.7	61.3	98.0	142.9	196.0	248.1	306.3
Douglas fir, western hemlock 1,200 $(1-l/60d)$	5	11.3								
	6	10.6								
	7	9.8	25.4							
	8	9.1	24.9							
	9	8.3	23.7	45.2						
	10	7.5	22.6	45.2						
	11	....	21.5	43.7						
	12	....	20.4	42.2	70.7					
	14	....	18.1	39.2	67.9	101.8				
	16	....	....	36.2	64.1	99.5	138.5			
	18	....	....	33.2	60.3	95.0	137.2	181.0		
	20	....	....	30.2	56.5	90.5	132.0	181.0	229.0	282.7
Shortleaf pine, spruce 1,100 $(1-l/60d)$	5	10.4								
	6	9.7								
	7	9.0	23.3							
	8	8.3	22.8							
	9	7.6	21.8	41.5						
	10	6.9	20.7	41.5						
	11	....	19.7	40.1						
	12	....	18.7	38.7	64.8					
	14	....	16.6	35.9	62.2	93.3				
	16	....	....	33.2	58.7	91.2	127.0			
	18	....	....	30.4	55.3	87.1	125.8	165.9		
	20	....	....	27.6	51.8	82.9	121.0	165.9	209.9	259.2
White pine, Tamarack 1,000 $(1-l/60d)$	5	9.4								
	6	8.8								
	7	8.2	21.2							
	8	7.5	20.7							
	9	6.9	19.8	37.7						
	10	6.3	18.9	37.7						
	11	....	17.9	36.4						
	12	....	17.0	35.2	58.9					
	14	....	15.1	32.7	56.5	84.8				
	16	....	....	30.2	53.4	82.9	115.5			
	18	....	....	27.6	50.3	79.2	114.4	150.8		
	20	....	....	25.1	47.1	75.4	110.0	150.8	190.9	235.6

Loads in small figures above horizontal lines are the maximum allowable safe loads.

METHOD OF CHECKING LUMBER PRICES

It is often important for a contractor to be in a position to check up the quotations which he receives from local lumber dealers. This is possible if the contractor has available the wholesale quotations on lumber such as are published monthly by the *New York Lumber Trade Journal.*

In using these quotations, the contractor should bear in mind that the prices quoted are approximately those which his dealer has to pay the mills, and that to the quoted price must be added:

1. A freight charge. If there is no wholesale quotation for lumber available, at the town or city at which the dealer is located, it will be necessary to determine the approximate amount of freight which he has to pay. This can be figured if the weight of the lumber and the proper freight rates are known. Probably the safest way for a contractor to determine the proper amount of freight to allow would be for him to consult the local freight agent.

2. An amount to cover yard handling and delivery by the dealer. This includes unloading the lumber from steamers or cars at his lumber yard; sorting and piling; reloading on trucks and delivery to and unloading at the site of the job. This charge will be from $6 to $12 a thousand feet.

3. The lumber dealer's profit.

For the convenience of those who are not familiar with the wholesale quotations mentioned above, through the courtesy of the *New York Lumber Trade Journal,* we are inserting a copy of their quotations for September 1, 1923, as well as their table of freight rates between various points.

PRESENT MARKET PRICES OF LUMBER

Important.—The quotations given in this Section are the wholesale selling prices to the retail trade on well-manufactured and graded stock. They are as nearly correct as a thorough knowledge of each market can make them, and in no wise should be construed as pertaining to the market price of any lumber which does not come up to the inspection rules at present obtaining in the respective markets quoted. Neither should they be taken by mill men as a basic price for stock f.o.b. at the mills. Prices vary according to manufacture, average width, length and dryness.

NEW YORK

Ash White

4/4 in. 1st and 2ds	$120
5/4 and 6/4 in. 1st and 2ds	130
8/4 in. 1st and 2ds	150
2½ and 3 in. 1st and 2ds	168
4/4 in. No. 1 common	75
5/4, 6/4 and 8/4 in. No. 1 common	92 to 98
5/4 in. No. 2 common	52
4/4 in. No. 2 common	47

Basswood

4/4 in. 1st and 2ds	$100
5/4 and 6/4 in. 1st and 2d	105
8/4 in. 1st and 2ds	110
4/4 in. No. 1 common	70
5/4 No. 1 common	75
6/4 No. 1 common	75
8/4 No. 1 common	80
4/4 in. No. 2 common	40
5/4 and 6/4 in. No. 2 common	43
8/4 No. 2 common	45

Beech

4/4 1st and 2ds	$80 to $90
5/4, 6/4 and 8/4 1st and 2d	90 to 95
4/4 No. 1 common	.. 55
5/4, 6/4 and 8/4 No. 1 common	60 to 65
4/4 No. 2 common	.. 37
5/4, 6/4 and 8/4 in. No. 2 common	42 to 45

Birch

4/4 in. 1st and 2ds red	... $145
4/4 in. 1st and 2ds saps	... 135
5/4, 6/4 and 8/4 in. 1st and 2s saps	140 to 150
2½, 3 and 4 in. 1st and 2ds unselect	150 to 160
4/4 in. No. 1 common sap	... 70
5/4, 6/4 and 8/4 No. 1, common sap	85 to 95
4/4 in. No. 2 common unselected	... 42
5/4, 6/4 and 8/4 No. 2 common	42 to 50

White Cedar (Juniper)

Boat boards

4/4, 6 in. to 18 in. wide, average 10 in.	$100
5/4 and 6/4, 6 in. to 18 in. wide, average 10 in.	115

Lengths runs 10 to 18 ft., best quality stock running about 50 per cent clear of knots.

Cherry

4/4 in. 1st and 2ds	$170 to $180
5/4, 6/4 and 8/4 in. 1st and 2ds	180 to 200
4/4 in. No. 1 common	90 to 100
5/4, 6/4 and 8/4 in. No. 1 common	110 to 130
4/4 in. No. 2 common	65 to ...
5/4, 6/4 and 8/4 in. No. 2 common	65 to 75

Chestnut

4/4 1st and 2ds	$130
5/4, 6/4 and 8/4 1st and 2ds	145 to $150
4/4 No. 1 common	85
5/4, 6/4 and 8/4 No. 1 common	92.50 to 97.50
4/4 wormy	40
4/4 wormy and No. 2 common	38

Gum, Plain (Red)

	Firsts and Seconds	No. 1 Common
4/4	$100	$65
5/4	105	70
6/4	105	70
8/4	110	75

Gum, Quartered (Red)

	Firsts and Seconds	No. 1 Common
4/4	$110	$75
5/4	120	80
6/4	120	80
8/4	125	85

Mahogany Lumber Honduras and Mexican

	Firsts and Seconds	No. 1 Common	No. 2 Common
3/8 in.	$130	$105	$70
1/2 in.	150	125	85
5/8 in.	175	140	100
3/4 in.	200	155	110
4/4 in.	225	175	125
5/4 in.	230	180	130
6/4 in.	235	185	135
8/4 in.	240	190	140
10/4 in.	250	200	150
12/4 in.	260	210	160
16/4 in.	270	220	170

Shorts, 2 ft. to 6 ft. long, 7 in. up wide

5/8	$130
3/4	140
4/4	165
5/4	170
6/4	175
8/4	180
10/4	190
12/4	200
16/4	210

Philippine Mahogany

Prices depending on selection for color, figure and freedom from pin holes.

1	$140 to $160
1¼, 1½, 2	150 to 170
2½, 3, 4	170 to 190

Maple, Hard and Soft

4/4 in. 1st and 2ds	... $110
5/4 and 6/4 in. 1st and 2ds	$120 to 125
8/4 in. 1st and 2ds	... 130
2½ and 3 in. 1st and 2ds	150
4/4 in. No. 1 common	... 65
5/4, 6/4 and 8/4 in. No. 1 common	80 to 90
4/4 in. No. 2 common	... 40
5/4, 6/4 and 8/4 in. No. 2 common	42 to 47

Oak (Plain)

Mixed, Rock, Mountain or W. Va. Stock

4/4 in. 1st and 2ds	$130
5/4, 6/4 and 8/4 in. 1st and 2ds	135 to $140
4/4 in. No. 1 common	85
5/4, 6/4 and 8/4 in. No. 1 common	95 to 100
4/4 in. No. 2 common	62
5/4, 6/4 and 8/4 in. No. 2 common	64 to 70

Oak, Quartered White

Strictly white, 4/4 1s and 2ds	$165
5/4 to 8/4 1s and 2ds	195
4/4 No. 1 common	100
Quartered oak strips, clear face	110

Poplar, Yellow (Rough)

5/8 1st and 2ds, 7 to 17 in	$106.00
1 in. 1st and 2ds, 7 to 17 in	135.00
1¼, 1½ and 2 in. 1st and 2ds	139.50 to 142.50 to 147.50
1 in. saps	105.00
1¼ and 1½ in. saps	115.00
2 in. saps	120.00
5/8 No. 1 common	62.50
1 in. No. 1 common	82.50
1 in. No. 2 common or culls	44.00
1¼, 1½ and 2 in. No. 2 common	46.00 to 50.00

Hardwood Squares

Poplar

8 by 8 1s and 2ds	$185
6 by 6 1s and 2ds	190

Birch and Maple

4 by 4 1s and 2ds	$155
5 by 5 1s and 2ds	160
6 by 6 1s and 2ds	165
7 by 7 1s and 2ds	175
8 by 8 1s and 2ds	190
9 by 9 1s and 2ds	215
10 by 10 1s and 2ds	235

Yellow Pine Dimension—Merchantable—1905

Steamer delivery. Rail delivery add $6 per M.

3 by 4 and 4 by 4	$48
3 by 6 and 6 by 6	46
3 by 8, 4 by 8, 6 by 8 and 8 by 8	46
3 by 10	54
10 by 10	50
3 by 12	60
12 by 12	57
3 by 14	65
14 by 14	62

Lengths 22 and 24 ft. add $2.
Each 2 ft. additional add $1 up to 32 ft.

Yellow Pine (Short Leaf)

4 by 6	$39	6 by 12	$45
4 by 8	39	6 by 8	39
4 by 10	42	8 by 12	45
6 by 8	39	6 by 12	45
6 by 10	41		

The above prices are for ordinary lengths 10 to 20 ft.; 22 to 24 ft. long add $1.

Railroad Ties—Yellow Pine

F.o.b. New York

Heart Grade		Sap Grade	
7 by 9 by 8 ft. 6 in	$1.90	7 by 9 by 8 ft. 6 in	$1.40
7 by 8 by 8 ft. 6 in	1.80	7 by 8 by 8 ft. 6 in	1.30
6 by 8 by 8 ft. 6 in	1.70	6 by 8 by 8 ft. 6 in	1.15

North Carolina Pine—Kiln Dried

F.o.b. car at New York

Rough	No. 2 and B't'r	No. 3	No. 4
4/4 Edge, under 12	$65	$47	$32.00
1 by 6	68	52	34.50
1 by 8	70	52	34.50
1 by 10	72	54	35.50
1 by 12	77	56	36.50
5/4 Edge, under 12	71	52	34.00
5/4 by 6	76	55	35.50
5/4 by 8	76	55	36.50
5/4 by 10	86	65	37.50
5/4 by 12	91	70	38.50
6/4 Edge	73	54	35.00
6/4 by 6	78	57	36.50
6/4 by 8	78	57	37.50
6/4 by 10	88	67	38.50
6/4 by 12	93	72	39.50
8/4 Edge	77	56	35.00
8/4 by 6	80	59	
8/4 by 8	80	59	
8/4 by 10	90	69	
8/4 by 12	95	74	

	Edge	8 in.	10 in.	12 in.
4/4 No. 2 box	$29	$31.50	$32.50	$33.50
No. 1 and 2 bark strips	48			
Box bark strips	24			

Dressed North Carolina Pine

Flooring	No. 2 and B't'r	No. 3	No 4
13/16 by 2½ and 3 in. rift	$90		
13/16 by 2½ and 3 in. flat	68	$57	$31.00
Ceiling and Partition			
13/16 by 2½ and 3	69	58	
7/16	40	30	21.25
3/8			
Roofers			
13/16 by 5½	..	..	33.50
13/16 by 7½	..	..	33.50
13/16 by 9½	..	..	34.50
13/16 by 11½	..	..	35.50

Cypress

By car, F.o.b. New York

Lumber, rough or dressed

First and seconds, 1 in	$107
First and seconds, 1¼ in	112
First and seconds, 1½ in	115
First and seconds 2	122
First and seconds, 2½ in	135
First and seconds, 3 in	140
Selects, 1 in	95
Selects, 1¼ in	100
Selects, 1½ in	102
Selects, 2 in	110
Selects, 2½ in	120
Selects, 3 in	120
No. 1 shop, 1 in	65
No. 1 shop, 1¼ in	73
No. 1 shop, 1½ in	76
No. 1 shop, 2 in	82
No. 1 shop, 2½ in	90
No. 1 shop, 3 in	92

Cypress Shingles

6- by 18-in. hearts	$15
6- by 18-in. primes	13

New Brunswick White Cedar Shingles

(F.o.b. New York)

Extras	$6.45 to $6.70
Clears	5.45 to 5.70
2d clears	3.95 to 4.20
Clear whites	3.70 to 3.95

Red Cedar

F. o. b. New York and points common,
Beveled siding in cars mixed with clears of extra stars.

1/2 by 6 clear	$46.25
1/2 by 6 A	43.25
3/4 by 10 clear and b't'r	90.25
3/4 by 12 clear and b't'r	90.25

Washington Red Cedar Shingles

(Rail)

	M.
18-in. Eurekas	$5.42
18-in. Perfections	6.13
16-in. clears	4.61
16-in. stars (6/2)	3.96
By water: Washington Perfections, f.a.s. ship	6.00

Fir Water Shipments

The average eastern yard schedule of No. 1 common rough fir delivered New York Harbor $41. Dressed $40.

Clear V. G. Fir Flooring

F.o.b. New York

	No. 1	No. 2	No. 2 and B'T'R	No. 3
1 by 3	...	...	$76.50	$66.50
1 by 4	$75	72	.....	56.00
5/4 by 3	...	...	81.25	73.25
5/4 by 4	...	...	78.25	70.25

Clear S. G. Fir Flooring

	No. 2 and B'T'R	No. 3
1 by 3	$60	$56
1 by 4	60	56

Clear Fir Ceiling C. & E. B. 2S

	No. 2 and B'T'R	No. 3
5/8 by 4	$53.50	$47.00
5/8 by 6	56.50	53.50
1 by 4	60.00	56.00
1 by 6	63.00	60.00

Clear Fir Novelty Siding

	No. 2 and B'T'R	No. 3
1 by 6	$62	$59
1 by 8	70	59

Clear V. G. Fir Stepping

	No. 2 and B'T'R	No. 3
5/4 by 10 and 12	$94.25	$84.25
6/4 by 10 and 12	94.25	84.25

Flooring

13–16 Oak, 2, 2¼

Clear quartered white oak flooring	$150
Select quartered sawed white	105
Clear quartered red	130
Select quarter sawed red oak flooring	100
Clear plain sawed white oak flooring	108
Select P. S. white oak flooring	95
Clear plain sawed red oak flooring	100
Select P. S. red oak flooring	92

Maple Flooring

F.o.b. New York City

Grade	13/16- by 2 in. Face	13/16- by 2¼ in. Face	13/16- By 3¼ in. Face	⅜- by 1½ and 2 in. Face
Clear	$105	$113.25	$95	$68
No. 1	90	103.25	89	55

Standard Sizes

The above only are standard stock widths in matched. Standard thickness $^{13}/_{16}$ in.

Jointed 2½-in., 3½-in. and wider only are standard widths, priced $3 more than matched.

Flooring $1^{1}/_{16}$ in. thick, $10 more than $^{13}/_{16}$ in. in Clear Factory and No. 1.

Flooring of any width $^{13}/_{16}$ in. or thicker is measured ¾ in. waste for matching, or ½ in. waste for joining.

Flooring ⅜ in. thick is measured ½ in. waste for matching.

Long Leaf Yellow Pine Flooring

F.o.b. New York (Rail)

$^{13}/_{16}$ by 2⅜ face, B. and b't'r heart rift	$102.25
$^{13}/_{16}$ by 2⅜ face, B. and b't'r sap rift	91.25
$^{13}/_{16}$ by 2⅜ face, B. and b't'r sap flat	65.25
$^{13}/_{16}$ by 2⅜ No. 1 common sap flat	56.25
$^{13}/_{16}$ by 2⅜ No. 2 common sap flat	38.25

Spruce (Eastern) (Random Cargoes)

(Nova Scotia cargoes) delivered New York

6 to 9 in	$35 to $40
10 and 12 in	45 to 50

SPRUCE (WEST VIRGINIA)

1 by 2 in., rough or S 1 S	$49.50
1 by 2½ in., rough	51.50
1 by 3 and 1 by 4 in., rough, 10 to 16 ft	48.50
1 by 6, 8, 10 in., rough, 10 to 14 ft	48.50
1 by 6, 8, 10 in., rough, 16 ft	50.50
1 by 6, 8, 10 in., rough, 18 and 20 ft	50.50
1 by 12 in., rough, 10 to 14 ft	51.50
1 by 12 in., rough, 16 ft	53.50
1 by 12 in., rough, 18 and 20 ft	53.50
5/4 and 6/4, 8 in., rough, 10 to 14 ft	50.50
5/4 and 6/4, 8 in., rough, 16 to 20 ft	52.50
5/4 and 6/4, 10 in., rough, 10 to 14 ft	51.50
5/4 and 6/4, 10 in., rough, 16 to 20 ft	53.50
5/4 and 6/4, 12 in., rough, 10 to 14 ft	53.50
5/4 and 6/4, 12 in., rough, 16 to 20 ft	55.50
2 by 3 in. and 2 by 4 in., 10, 12, 14 ft	46.50
2 by 3 in. and 2 by 4 in., 16 ft	48.50
2 by 3 in. and 2 by 4 in., 18 and 20 ft	50.50
2 by 6 and 8 in., 10, 12 and 14 ft	45.50
2 by 10 in., 10, 12 and 14 ft	46.50
2 by 6 and 8 in., 16 ft	47.50
2 by 10 in., 16 ft	48.50
2 by 6 and 8 in., 18 and 20 ft	49.50
2 by 10 in., 18 and 20 ft	50.50
2 by 12 in., 10, 12, 14 ft	47.50
2 by 12 in., 16 ft	49.50
2 by 12 in., 18 and 20 ft	51.50
3 by 4 to 8 by 8 in., 10 to 14 ft	47.50
3 by 4 to 8 by 8 in., 16 ft	49.50
3 by 4 to 8 by 8 in., 18 and 20 ft	51.50
3 by 10 in., 10 to 14 ft	47.50
3 by 10 in., 16 ft	49.50
3 by 10 in., 18 and 20 ft	51.50
3 by 12 in., 10 to 14 ft	48.50
3 by 12 in., 16 ft	50.50
3 by 12 in., 18 and 20 ft	52.50
4 by 10 to 10 by 10 in., 10, 12 and 14 ft	48.50
4 by 10 to 10 by 10 in., 16 ft	50.50
4 by 10 to 10 by 16 in., 18 ft	52.50
4 by 12 to 12 by 12 in., 10, 12 and 14 ft	49.50
4 by 12 to 12 by 12 in., 16 ft	51.50
4 by 12 to 12 by 12 in., 18 ft	53.50

For 2 in. and thicker 14 in. wide add $2 to price of 3 by 12s.
For 2 in. and thicker 16 in. wide add $4 to price of 3 by 12s.

1 by 9 in., same price as 1 by 12 in.
2 by 9 in., same price as 2 by 12 in.
3 by 7 in., same price as 3 by 8 in.
3 by 9 in., same price as 3 by 12 in.

Add $1 per M. for every 2 ft. in lengths over 20 ft. Dressing or working boards or sizes $2 per M.

Canada Spruce

Merchantable rough F.o.b., New York, rail delivery

	10 to 16 Ft.	12/13 Ft.	9/10/16 Ft.
1 by 3	$43		
1 by 4	43		
1 by 5	43		
1 by 6	44	$46.00	
1 by 8	46	48.00	
1 by 9	50	53.00	
1 by 10	50	53.00	
1¼ by 2	43	44.00	
1¼ by 3	45	45.00	
1¼ by 4	43	44.00	
1¼ by 5	43	44.00	
1¼ by 6	46	47.00	
1¼ by 8	48	50.00	
1¼ by 9	55	56.00	
1¼ by 10	55	56.00	
2 by 3	..	41.00	$44
2 by 4	..	41.00	
2 by 5	..	41.00	
2 by 6	41	41.50	
2 by 8	46	46.00	
2 by 9	50	52.00	
2 by 10	50	52.00	
1 by 2, 10 to 16 ft., S1S	..	.....	41
1 by 2½, 10 to 16 ft., S1S	..	.....	41
3 by 4, 4 by 4, 3 by 6, 4 by 6	..	.....	42

All 12 and 13 ft. 85 per cent 12 ft.

Adirondack Spruce

F.o.b. New York. Track delivery

1 by 4, 12/16	$44
1 by 5, 12/16	43
1 by 6, 12/16	45
1 by 7, 12/16	45
1 by 8, 12/14	49
1 by 8, 16	50
1 by 9, 12/14	49
1 by 10, 12/14	51
1 by 10, 16	52
5/4 by 4, 12/14	45
5/4 by 5, 12/14	45
5/4 by 6, 12/14	47
5/4 by 7, 12/14	47
5/4 by 8, 12/14	50
5/4 by 9, 12/14	58
5/4 by 10, 12/14	56
2 by 4, 8/13	45
2 by 5, 8/16	43
2 by 6, 12/14	43
2 by 6, 16	45
2 by 7, 12/16	44
2 by 8, 12/14	48
2 by 8, 16	50
2 by 9, 12/14	55
2 by 10, 12/14	51
2 by 10, 16	53
1 by 2 furring, 10/10, p1S and bld	42

Lath

Eastern Spruce

1½-in. slab (by vessel)	$8.25 to $8.50
1½-in. slab lath (by rail)	8.25 to 8.50

California Redwood, Delivered Prices

Territory east of Buffalo and Pittsburgh, including New England.
Dry stock, dressed or rough. Dressed, 4 sides, add $4.

8 to 12 In. Assorted	Clear	A	No. 1 Shop
4/4	$ 99.00	$ 94.50	$53.00
5/4	106.00	102.50	74.00
6/4	106.00	102.50	74.00
8/4	104.00	100.00	65.00
10/4	122.50	.....	90.50
12/4	117.50	.....	85.00
16/4	122.50	.....	87.50

Stand. 15/32-in. beveled siding

	Clear	A
4 in	$48.50	$46.50
5 in	50.00	48.50
6 in	48.50	46.50

Colonial beveled siding

	Clear	A
11/16 by 10	$85.50	$83.50
11/16 by 12	87.50	85.50
Assorted 10 in. as average.		

New York White Pine Prices

Rough or Dressed

F.o.b. Rail at New York

Uppers

4–4	$232	10–4 and 12–4	$257
5–4 and 6–4	232	16–4	282
8–4	232		

Selects

4–4	$207	10–4 and 12–4	$232
5–4, 6–4 and 8–4	207	16–4	257

Fine Common

4–4 by 8 and wider	$187	6–4 by 8 and up	$192
1 by 8 to 11	182	6–4 by 12	202
1 by 12	202	8–4 by 8 and up	192
5 by 4 by 8 and up	192	8–4 by 12	202
5 by 4 by 12	202	10–4 and 12–4	232
		16–4	257

No. 1 Cuts

4–4	$137	8–4	$172
5–4	162	10–4 and 12–4	192
6–4	167	16–4	202

No. 2 Cuts

4–4	$ 94	8–4	$134
5–4	124	10–4 and 12–4	149
6–4	129	16–4	164

No. 3 Cuts

4–4	$ 68	6–4	$ 83
5–4	73	8–4	85

No. 1 Moldings

4–4 by 4 to 7	$157	6–4	$167
5–4	167	8–4	172

No. 2 Moldings

4–4 by 4 to 7	$127	6–4	$137
5–4 by 4 to 7	137	8–4	142

Stained Saps

4–4 by 4 and wider	$112	8–4	$132
5–4 and 6–4	127		

Shaky Clear

1 by 4 to 11	$117	8–4 by 4 to 11	$127
1 by 12	132	10–4 and 12–4	147
5–4 by 4 to 11	122	16–4	162
6–4 by 4 to 11	122		

Shelving and Dressing

1 by 4 to 11	$109	8–4	$119
5–4	114	8–4 by 12	134
6–4	119	16–4	149
6–4 by 12	134	10–4 and 12–4	144

No. 1 Shelving

1 by 10	$117	1 by 13 and wider	$132
1 by 12	122		

No. 2 Shelving

1 by 10	$100	1 by 13 and wider	$107
1 by 12	105		

	No. 1 Barn	No. 2 Barn	No. 3 Barn
1 by 4	$88	$73	$59
1 by 5	89	74	60
1 by 6	90	77	61
1 by 8	90	77	61
1 by 10	94	78	63
1 by 12	94	90	66
5–4	99	80	64
5–4 by 4	98	79	73
5–4 by 6 and 8	99	80	64
5–4 by 10	101	83	65
5–4 by 12	109	95	67
6–4	99	82	64
6–4 by 6 and 8	99	82	64
6–4 by 10	101	83	65
6–4 by 12	109	95	67
8–4	99	81	64
8–4 by 4	98	79	63
8–4 by 6 and 8	99	80	64
8–4 by 10	101	85	65
8–4 by 12	109	97	67

No. 1 Box

1 by 6 and wider, 25 per cent; 12 and wider	$56	5–4	$58
		6–4	58
1 by 4 to 11	55	8–4	58
1 by 12	58	10–4 and 12–4	66

No. 2 Box

4–4	$51	5–4, 6–4 and 8–4	$52

Idaho White Pine

	C Selected	D Selected	No. 1 Common	No. 2 Common	No. 3 Common
1 by 4 in	$ 95.50	$ 75.50	$68.00	$60.50	$51.50
1 by 6 in	95.50	77.50	68.00	62.50	55.50
1 by 8 in	97.50	78.50	68.00	60.50	57.00
1 by 10 in	103.50	83.50	73.50	61.50	57.00
1 by 12 in	120.50	94.50	76.00	63.00	58.50
1 by 13 in	125.50	120.50	76.00	65.00	61.50
5/4 by 8 up	150.00	128.50			
6/4 by 8 up	150.50	128.50			
8/4 by 8 up	150.50	128.50			

Dressed, for rough, add $3.25 per M feet

Baltimore

Southern Pine (Long Leaf)

All rail

Dimension stock sizes and timber	$60 to $70
Dimension stock, small sizes	45 to 50

Square edge about $1 to $2 less.

Yellow Pine (Short Leaf)

8-in	$29 to $30
10-in	31 to 32
12-in	32 to 33

Boston

Spruce

Dimension, 8 in. and under, 20 ft. and under	$48 to $50

Random Spruce

2 by 3, 2 by 4, 2 by 6, 2 by 7	$38
2 by 8	45
2 by 10	47

Boards

Spruce covering boards, 5-in. and up	$38 to $40
Matched spruce boards, clipped	42 to 45

Furring

1 by 2	$40

Spruce Laths

1½ in	$8.50
1⅝ in	9.50

Boston

Shingles

White cedar extras	$6.00 to $6.25
White cedar clears	5.25 to 5.50
Second clears	3.75 to 4.00
Clear white	3.50 to 3.75

Yellow Pine Dimension Merchantable—1905. Boston

3 by 4 to 4 by 4—20 ft. and under	$50
3 by 6 to 6 by 6—20 ft. and under	48
3 by 8, 4 by 8, 6 by 8, 8 by 8—20 ft. and under	48
3 by 10—20 ft. and under	56
10 by 10—20 ft. and under	52
3 by 12—20 ft. and under	62
12 by 12—20 ft. and under	59
3 by 14—20 ft. and under	67
14 by 14—20 ft. and under	64

Lengths 22 to 24 ft. add $1.

YELLOW PINE (SHORT LEAF)

4 by 6	$41	6 by 12	$47
4 by 8	41	8 by 8	41
4 by 10	44	8 by 10	47
6 by 8	41	8 by 12	47
6 by 10	43		

The above prices are for ordinary lengths 10 to 20 ft.
Lengths 22 to 24 ft. add $1.

HARDWOODS

Southern white ash, 1¼–1½-in., 1s and 2s	$130
Southern white ash, 2-in., 1s and 2s	140
Southern white ash, 2½-in., 1s and 2s	155
Southern white ash, 3-in., 1s and 2s	160
Southern white ash, 4-in., 1s and 2s	190
Southern white ash, 1-in., common	80
Southern white ash, thicker, common	95
Quartered oak, white, 1-in., 1st and 2ds	160
Quartered oak, white, 1¼, 1½ and 2-in., 1s and 2s	175
Quartered oak, white, 1-in., common	90
Plain oak, 1-in., 1s and 2s (white)	130
Plain oak, 1-in., 1s and 2s (red)	125
Plain oak, 1¼–1½-in., 1s and 2s (white)	140
Plain oak, 2-in., 1s and 2s (white)	145
Plain oak, 1-in., common (red) $70 (white)	80
Plain oak, thicker	90

Philadelphia

Cypress

Lumber, rough or dressed

Firsts and seconds, 1 in.	$105
Firsts and seconds, 1¼ in.	110
Firsts and seconds, 1½ in.	115
Firsts and seconds, 2 in.	120
Firsts and seconds, 2½ in.	125
Firsts and seconds, 3 in.	135
Selects, 1 in.	95
Selects, 1¼ in.	100
Selects, 1½ in.	105
Selects, 2 in.	108
Selects, 2½ in.	118
Selects, 3 in.	130
No. 1 shop, 1 in.	65
No. 1 shop, 1¼ in.	67
No. 1 shop, 1½ in.	72
No. 1 shop, 2 in.	82
No. 1 shop, 2½ in.	87
No. 1 shop, 3 in.	92

W. Va. Spruce—Merchantable

F.o.b., Philadelphia

50 cts. less than New York

Yellow Pine Merchantable—1905

2 by 4, 3 by 4, 4 by 4	$46	3 by 12	$58
3 by 6, 4 by 6, 6 by 8	44	12 by 12	55
3 by 8, 4 by 8, 8 by 8	44	3 by 14	63
3 by 10	52	14 by 14	60
10 by 10	48		

Lengths 22 to 24 ft. add $2.
Each 2 ft. additional add $1.50 to 32 ft.
Each 1 ft. over 32 ft. add $1.

Yellow Pine (Short Leaf)

4 by 6	$37	6 by 12	$43
4 by 8	37	8 by 8	37
4 by 10	40	8 by 10	43
6 by 8	37	8 by 12	43
6 by 10	39		

Hardwoods

Chestnut

4–4, 1s and 2s	$125 to $132
5–4, 6–4, 1s and 2s	130 to 135
4–4 common	80 to 85
5–4, 6–4 common	82 to 88
4–4, wormy and No. 2 common	35 to 42

Poplar

4–4, 1s and 2s, in. and up	$125 to $135
4–4 and 6–4, 1s and 2s, 7 in. and up	130 to 140
4–4 clear saps, 7 in. and up	85 to 100
5–4, 6–4, 8–4 clear saps, 7 in. and up	100 to 105
4–4 common	69 to 75
5–4, 6–4, 8–4 common 6 in. and up	74 to 80
4–4 No. 2 common	42 to 48
5–4, 6–4 No. 2 common	52 to 55

Oak Quartered White

4–4s, 1s and 2s, 6 in. and up	$130 to $140
Thicker, 1s and 2s, 6 in. and up	130 to 140
Plank	190
4–4 common	95

Oak, Plain White

4–4s, 1s and 2s, 6 in. and up	$125 to $140
Thicker, 1s and 2s, 6 in. and up	125 to 140
4–4, common, 4 in. and up	78 to 80
5–4, 6–4, No. 1 common	80 to 82
8–4 No. 1 common	78
4–4, 4 in. and up, No. 2 common	53

Ash

4s, 1s and 2s	$115 to $120
5–4, 6–4, 8–4, 1s and 2s	130 to 135
10–4, 12–4, 1s and 2s	138 to 142
4–4 common	70 to 73
5–4, 6–4, common	
8–4, common	

Cincinnati

F.o.b. Cincinnati

WHITE ASH

4/4 in. 1st and 2ds	$115
5/4 and 6/4 in. 1st and 2ds	130
8/4 in. 1st and 2ds	140
2½ and 3 in. 1st and 2ds	160
4/4 in. common	65
5/4, 6/4 in. common	75
4/4 in. No. 2 common	35
5/4, 6/4 and 8 in. No. 2 common	40

BASSWOOD

4/4 in. 1st and 2ds	$ 95
5/4, 6/4 and 8/4 in. 1st and 2ds	100
4/4 in. common	65
5/4, 6/4 and 8/4 in. common	70
4/4 in. No. 2 common	35
5/4 and 6/4 in. No. 2 common	35

CHERRY

	1s AND 2s	No. 1 COMMON	No. 2 COMMON
4/4	$160	$100	$50
5/4	170	110	52
6/4	170	112	52
8/4	190	120	58
10/4	200	135	60
12/4	220		
16/4	230		

F.o.b. cars St. Bernard, Ohio

CHESTNUT

4/4 1st and 2ds	$140
4/4 common	80
4/4 culls (sound and wormy)	35

RED GUM

1 in. 1st and 2ds	$115
1 in. No. 1 common	60

Plain Oak

4/4 in. 1st and 2ds	$120
5/4 and 6/4 in. 1st and 2ds	140
8/4 in. 1st and 2ds	150
4/4 in. common	75
5/4 and 6/4 common	85
8/4 in. common	85
4/4 in. No. 2 common	40
5/4 and 6/4 in. No. 1 common	45
8/4 in. No. 2 common	45

Oak, Quartered White

4/4 in. 1st and 2ds	$160
5/4 to 8/4	175
4/4 No. 1 common	80

Yellow Poplar (Rough)

5/8 in. 1st and 2ds, 7 in. to 17 in.	$115
1 in. 1st and 2ds, 7 in. to 17 in.	135
1¼, 1½ and 2 in., 1st and 2ds	145
1 in. saps	97
1¼, 1½ and 2 in. saps	110
1 in. No. 1 common	75
1¼, 1½ and 2 in. No. 1 common	80
1 in. No. 2 common	45
1¼, 1½ and 2 in. No. 2 common	50

Mahogany and Cedar Logs

The prices are in cents per foot, f.o.b. New York, according to Scribner-Doyle rule. Small wood subject to one-fifth rule.

Mexican Mahogany Cedar				
Cazones, Tecolutia	9–10			
Frontera	11	12	10	11
Leguna	11	12	10	11
Tiacotalpan	11	12	10	11
Minititlan	11	12	10	11
Tampico	11	12		

Mahogany Cedar				
Cuban	10	13	11	12
Honduras	11	11	10	11
Panama	10	11	9	10
Costa Rica	10	11	7	8
Para	..	..	8	9
Venezuela	10	11		
Nicaragua	10	11	9	10
[1]African	10	13		

[1]Graded under Liverpool Invoice.

Weights of Southern Yellow Pine When Worked to Standard Size

(As given by The Southern Pine Association)

Long Leaf Dry		Short Leaf Dry	
Flooring, $1\frac{3}{16}$ by $2\frac{1}{4}$	2,000	Flooring, $1\frac{3}{16}$ by $2\frac{1}{4}$	1,800
Flooring, $1\frac{3}{16}$ by $3\frac{1}{4}$	2,200	Flooring, $1\frac{3}{16}$ by $3\frac{1}{4}$	2,000
Flooring, $1\frac{3}{16}$ by $5\frac{1}{4}$	2,400	Flooring, $1\frac{3}{16}$ by $5\frac{1}{4}$	2,200
Ceiling, $\frac{3}{8}$	1,000	Ceiling, $\frac{3}{8}$	900
Ceiling, $\frac{1}{2}$	1,200	Ceiling, $\frac{1}{2}$	1,100
Ceiling, $\frac{5}{8}$	1,500	Ceiling, $\frac{5}{8}$	1,400
Ceiling, $\frac{3}{4}$	1,800	Ceiling, $\frac{3}{4}$	1,700
Partition, $\frac{3}{4}$	1,900	Partition, $\frac{3}{4}$	1,800
Siding, from inch stock	1,100	Siding, from inch stock	1,000
Siding, from $1\frac{1}{4}$ inch stock	1,400	Siding, from $1\frac{1}{4}$ inch stock	1,250
Drop siding to $\frac{3}{4}$	1,900	Drop siding, $\frac{3}{4}$ and moulded casing	1,800
Moulded casing, $4\frac{1}{2}$ to $5\frac{1}{4}$	2,000	Moulded base	2,000
Moulded base, from 8, 10, 12 inch stock	2,100	Finish, inch, S 1 S or S 2 S	2,500
Finish, inch S 1 S or S 2 S to $1\frac{3}{16}$	2,600	Finish, $1\frac{1}{4}$, $1\frac{1}{2}$ and 2 inch S 1 S or S 2 S	2,700
Finish, $1\frac{1}{4}$, $1\frac{1}{2}$ and 2 inch S 1 S or S 2 S to standard thickness	2,800	Finish, 1, $1\frac{1}{4}$, $1\frac{1}{2}$ and 2 inch, rough	3,200
Finish, 1, $1\frac{1}{4}$, $1\frac{1}{2}$ and 2 inch, rough	3,400		
Shipping Dry		**Shipping Dry**	
Shiplap and D. & M. $\frac{3}{4}$	2,400	Shiplap and D. & M. $\frac{3}{4}$	2,200
Grooved roofing $1\frac{3}{16}$	2,600	Grooved roofing	2,400
Common boards and fencing, 1 by 4, 6, 8 or 10 inch, S 1 S or 2 S $1\frac{3}{16}$	2,700	Common boards and fencing, 1 by 4, 6, 8, 10 inch, S 1 S or 2 S to $1\frac{3}{16}$	2,500
Common boards, 1 by 12 S 1 S or 2 S to $1\frac{3}{16}$	2,800	Common boards, 1 by 12, S 1 S or 2 S to $1\frac{3}{16}$	2,600
Common board. and fencing, 1 by 4, 6, 8 or 10 inch, rough	3,400	Common boards and fencing, 1 by 4, 6, 8, 10 inch, rough	3,300
Common boards, 1 by 12, rough	3,500	Common boards, 1 by 12, rough	3,400
2 by 4, 2 by 6 and 2 by 8, S 1 S 1 E to $1\frac{5}{8}$	2,700	2 by 4, 2 by 6 and 2 by 8, S 1 S 1 E to $1\frac{5}{8}$	2,500
2 by 4, 2 by 6 and 2 by 8, rough	3,400	2 by 4, 2 by 6 and 2 by 8, rough	3,300
2 by 10 and 2 by 12, S 1 S 1 E to $1\frac{5}{8}$	2,800	2 by 10 and 2 by 12, S 1 S 1 E to $1\frac{5}{8}$	2,600
2 by 10 and 2 by 12, rough	3,500	2 by 10 and 2 by 12, rough	3,300
Green		**Green**	
2 by 14 and 3 by 12, S 1 S 1 E	3,800	2 by 14 and 3 by 12, S 1 S 1 E	3,500
2 by 14 and 3 by 12, rough	4,500	2 by 14 and 3 by 12, rough	4,200
4 by 4 and 6 by 6, S 1 S 1 E	3,800	3 by 4 and 6 by 6, S 1 S 1 E	3,500
4 by 4 and 6 by 6, rough	4,500	4 by 4 and 6 by 8, rough	4,200
6 by 8 and over, rough	4,500	8 by 8 and over, rough	4,200
6 by 8 and over, S 4 S	3,800		
Plastering lath, dry	550	Plastering lath, dry	500
Byrkit lath, dry	1,800	Byrkit lath, dry	1,650

For hollow back flooring, ceiling and drop siding deduct 100 lb.

Freight Rates on Lumber in Carload Lots
(Cents per 100 pounds)

FROM \ TO		New York track delivery	Boston, Mass.	Philadelphia, Pa.	Baltimore, Md.	Albany, N. Y.	Utica, N. Y.	Syracuse, N. Y.	Rochester, N. Y.	Elmira, N. Y.	Pittsburg, Pa.	Buffalo, N. Y.	Cincinnati, O.	Chicago, Ill	Detroit, Mich.	East St. Louis, Ill.
Canada	Ottawa, Rock'd, Hawkesbury, Ont.	G. T. R.	31.5	31.5	36.5	36.5	22.5	21	21	21.5	31.5	38	26	36.5	38	29.5	61.5
	Arnprior, Ont.	G T. R.	35	35	39	39	26	24.5	24.5	24 5	35	40.5	29.5	39	40.5	29.5	64.5
	Pembroke, Ont.	G. T. R.	36.5	36.5	40.5	40.5	27.5	26.5	26.5	26.5	36.5	42	31.5	40.5	42	20.5	68
Alabama	Birmingham—I. C. L. & N. C. of Ga. & So. A. G. S		44.5	48	39.5	36	44.5	44.5	44.5	43.5	44.5	43	43	27.5	35.5	40	29.5
	Decatur—L. & N. and So.		44.5	47	42	41	43	41.5	39	37.5	39	33	33	25	36.5	39	29
	Lockhart—L. & N. C. of Ga.																
	Mobile—L. & N. and So.																
	Montgomery—C. of Ga., L. & N. & S. A. L.																
Arkansas	Helena—Y. & M. V.		?	49.5	44.5	43.5	45.5	44	42	40	42	38	38	26	31	35.5	18.5
	Little Rock, Rock Island Lines		49	54	49	49	49	49	49	48.5	49	46	46	34	35.5	41.5	27.5
California	San Francisco & Coast Group—So. Pac.		90	90[1]	90	90	90	90	90	90	90	88.5	88.5	85	73	85	73
	Hawley Group—Truckee Group (So. Pac.)		87	87	87	87	87	87	87	87	87	85.5	85.5	82	70	82	70
	Redwood Gp—Eureka, Ft. Bragg Scotia N. W. Pac.		90	90	90	90	90	90	90	90	90	88.5	88.5	85	73	85	73
Florida	Jacksonville—S. A. L., A. C. L.																
	Tampa—S. A. L.																
	Live Oak, A. C. L. & S. A. L.																
Georgia	Macon—C. of Ga.		41	44.5	36	36	45.5	45.5	45.5	45.5	....	43.5	44.5	31.5	39	43.5	34.5
	Savannah—C. of Ga.; So.; A. C. L.; S. A. L.		....	....	....	....	....	....	....	....	....	41	44.5				
	Waycross—A. C. L.																
Idaho	Inland Empire Group (See Spokane)																
Illinois	Cairo—Ill. Cent. & Big 4		43.5	45.5	41.5	40.5	42.5	40.5	38	34.5	38	31.5	31.5	20.5	17	25	13
	E. St. Louis—I. C., P. R. R., Wab., B. & O. 4, So. Ry.		42 5	44.5	40.5	39.5	40 5	39	38.5	34	38.5	31	31	16	13	21.5	
Indiana	Evansville—Big 4		42.5	41.5	37.5	36.5	38.5	37.5	34.5	32	....	28.5	28.5	16	18.5	21.5	13
	Indianapolis—P. R. R. & Big 4		36 5	38.5	34.5	33.5	34.5	33	29	27	....	27	27	15.5	16	22	20.5
Kentucky	Louisville—B. & O., L. & N., Big 4, So. Ry.		36.5	38 5	34.5	33.5	34.5	33	29	27	....	25	25	15	19.5	22	20.5
Louisiana	Alexandria—Rock Is., So. P.		49	54	49	49	49	49	49	48.5	49	47.5	47.5	34	39.5	44.5	29.5
	New Orleans—N O. & N E., Ill. Cent., L. & N.		49	52	47	45.5	49	49	49	46 5	49	45.5	45.5	29.5	38	43	29
	Shreveport—V. S. & P.		49	54	49	49	49	49	49	48.5	....	47.5	47.5	34	31.5	44 5	29.5
Michigan	Grand Rapids—N. Y. C., P. M.		45.0	42.5	38.5	37.5	40	38	34.5	32	34.5	27	26	24	21	19.2	28
	Menominee—Ann Arbor, C. M. & St. Paul																
	Saginaw & Bay City—P. M. R. R, N. Y. C.																
	Traverse City—P. M. R. R.																
Minnesota	Duluth—C. M. & St. P., D. S. S. & A.		47	50	45	44	45.5	44.5	43	43	43	38	38	34	18.5	33	
	Twin Cities—C. M. & St. P., Soo																

Mississippi	Charleston—Ill. Cent.	49	52	47	45.5	48	46.5	44.5	42	44.5	40	40	26	34	39	23.5
	Greenwood—So. & Y. & M. V.	49	52	47	45.5	48	46.5	44.5	42	44.5	41.5	41.5	27.5	35.5	41.5	25
	Hattiesburg—A. & V.	47A	51	44.5A	43A	47A	47A	47A	46.5	47A	45.5	45.5	29.5	38	43	29
	Jackson—A. & V.	47A	51	44.5A	43A	47A	47A	47A	46.5	47A	45.5	45.5	29.5	38	43	29
	Laure —Q. & C.	47A	51	44.5A	43A	47A	47A	47A	46.5	47A	45.5	45.5	29.5	38	43	29
	Meridian—A. & V.	47A	51	44.5A	43A	47A	47A	47A	46.5	47A	45.5	45.5	29.5	38	43	29
Missouri	St. Louis—P., I. C., Wab., B. & O., Big 4, So.	42.5	44.5	40.5	39.5	40.5	39	38.5	34	36.5	31	31	16	15.5	21.5	
Montana	Kalispel	87	87	87	87	87	87	87	87	87	85.5	85.5	82	70	82	70
N. Carolina	Asheville—So. R. R.	43.5	46.5	....	33	43	43	43	41.5	34.5	39	39	27	42.5	42	36
	Goldsboro—So. R. R.															
	Rocky Mount—A. C. L.															
	Salisbury—So.	39.5	42	30	29	38.5	38.5	38.5	38.5	30.5	36	39.5	34	45.5	41	43
Ohio	Cincinnati—B. & O., P. R. R., Big 4	33.5	35	31.5	30.5	31.5	29.5	25	22.5	....	18.5	18.5	....	18.5	18.5	18.5
	Cleveland—P. R. R., N. Y. C.	33.5	35.5	31.5	30.5	32	26.5	25	21	25	17	20	21.5	24	18	29
	Columbus—P. R. R., Big 4, N. & W.															
	Toledo—N. Y. C., P. R. R., B. & O.	35	37	33.5	32.5	34	33	29.5	28	29.5	21.5	22.5	20.5	21.5	13.5	26.5
Oregon	Baker	87	87	87	87	87	87	87	87	87	85.5	85.5	82	70	82	70
	Portland and associated cities	90	90	90	90	90	90	90	90	90	88.5	88.5	85	....	85	
S. Carolina	Barnwel —So. R. R.															
	Columbia—S. A. L. & So.															
Tennessee	Chattanooga—N. C. & St. L., So., Q. & C.	41.5	43.5	39	38	40	38.5	36	34	36	34	34	20	35.5	35.5	27
	Knoxville—So.	41.5	43.5	39	36.5	40	38.5	36	34	36	34	34	20	35.5	35.5	34
	Memphis—L. & N., So., I. C., N. C. & St. L.	44 5	47	42	41	43	41.5	39.5	37.5	39.5	35.5	35.5	22	29.5	34	18.5
	Nashville—N. C. & St. L., L. & N.	41.5	43.5	39	38	40	38.5	36	34	....	34	34	20	32	33	20
Texas	Beaumont—G. C. & S. F.	49	54	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	35.5	39.5	43.5	29.5
	Houston—G. C. & S. F.															
Virginia	Basic—N. & W.															
	Lynchburg—N. & W., C. & O., So.	31.5	35	28.5	23.5	33	33	33	33	33	29	33	29	34.5	29	40.5
	Norfo'k—East via N. Y. P. & N., W. via C. & O.	29.5	....	25	21.5	....	....	....	33	29	29	33	29	34.5	29	40.5
	Pulask —N. & W.—Note V.	40	42.5	34.5	32	39	39	39	39	....	36	38.5	28.5	41	36.5	42.5
	Richmond—C. & O., So., N. & W.	29 5	....	25	21.5	....	....	....	....	29	29	33	29	34.5	29	40.5
Washington	Seattle, Tacoma and associated cities	90	90	90	90	90	90	90	90	90	88.5	88.5	85	73	85	73
	Spokane	87	87	87	87	87	87	87	87	87	85.5	85.5	82	70	82	70
W. Virginia	Charleston—C. & O.	36	38	34	33	33	33.5	30	28	30	20.5	23.5	16	25	20.5	27
	Marinton—C. & O.	33	36	30	28.5	36	36	36	36	33.5	28.5	33	25	33	28.5	34.5
	Parkersburg—B. & O.	....	....	....	....	....	30.5	26.5	24.5	....	....	....	16	23.5	20.5	26.5
	Sutton—B. & O.															
Wisconsin	Milwaukee—P. M. RR., C. M. & St. P.															
	Oshkosh—C. M. & St. P.															

NOTE A.—Applies on Yellow Pine only.

CHAPTER XII

FINISH CARPENTRY AND MILLWORK

There are two general ways of preparing bids for finish carpentry or millwork. One is for a general contractor to buy his millwork from a trim shop at a lump sum price, and to figure the cost of installing it as a percentage, using about 40 to 50 per cent of its cost, thus making no estimate either of material or of labor. The other method is to take off and list all millwork, and price it from mill catalogues, adding a labor charge for each item.

Estimating Millwork.—There are a number of concerns which publish very comprehensive catalogues of all kinds of standard millwork, and any estimator who intends to figure this work should have such a catalogue, together with a price list and current discounts at his command to enable him to prepare reliable estimates on material delivered at the job. At the same time, in using such a catalogue, it must always be borne in mind that the material ordered, as far as possible, should be strictly stock, for the price of all special work is considerably in advance of the price of stock material.

In case a considerable amount of special millwork is required, it will be desirable to have a mill concern prepare an estimate for these items, since the estimating of them is somewhat difficult. If, however, it is found impossible to secure mill quotations in time for use, an idea of what special millwork will cost can be obtained by reducing the items to molding inches. A molding inch is the equivalent of a piece of wood, 1 in. square and 1 ft. long. In figuring molding inches, the full width of the stock from which the piece is cut must be used. If list prices per molding inch for the kinds of wood required can be obtained from a reliable concern, this method can be used with safety for rough estimating.

In specifying windows, the width should always be given first, followed by the height and then by the thickness. Windows can be measured either by the glass size or the opening size. If glass measurement is used the correct method is to designate the size in

inches only, with the width first, followed by the height in inches only, and then the number of lights and thickness, viz.: 26 by 28 in. 2-light, 1⅜ in. If the opening size is given, the width should be given first in feet and inches, followed by the height in feet and inches, and then by the thickness and the number of lights, viz. 2 ft. 6 in. by 5 ft. 2 in., 1⅜ in. 2-light.

The measurements of doors as well as windows, should always be designated with the width first, followed by the height and the thickness.

Interior moldings such as base, base shoe, picture molding, beam ceiling, chair rail, panel molding, etc., are measured by the lineal foot.

Door and window side casing, stops, head casing, cap molding, fillet, window stool, window apron and other materials needed to trim door and window openings can be measured either by the lineal foot or as sides of trim. A side of window trim includes all the different millwork members used on the inside of the sash. A side of door trim includes all the millwork members required for trimming one side of the door. It requires two sides of door trim to complete an inside door and one side of door trim for an outside door. The door stops which are used only on one side of a door should not be included with the door trim. The door stops should either be listed separately or with the set of interior jambs (interior door frame). In listing door and window trim, the width of the opening should always be given first, followed by the height, with the complete list of all the different members wanted. Door jambs should also be listed giving the width first, followed by the height and width of the partition from the face of the plaster to the face of the plaster.

Special millwork such as casework, panels, stairwork, etc., require so much information in reference to measurements that no set rules can be given. For millwork of this character, complete specifications and sketches should be furnished to mill men.

In taking off the quantities of millwork, the number of lineal feet of lattice required to cover a given area, if the openings between the strips are the same as the width of the strips, is found by multiplying the area in square feet for

1⅛-in. wide lattice by 12
1⅜-in. wide lattice by 10
1¾-in. wide lattice by 8

Labor to Install Millwork

No.	Kind of work	Unit	Hours to do unit of work	
			Ordinary	First class
1	Installing 1-member wood base	100 L.F.	3	4
2	Installing 2-member wood base	100 L.F.	4	6
3	Installing 3-member wood base	100 L.F.	5	7
4	Installing chair rail	100 L.F.	2¾	4
5	Installing picture mould	100 L.F.	2¾	4
6	Installing plate rail	100 L.F.	7½	12
7	Installing wood cornice, 3- or 4-member	100 L.F.	12	18
8	Installing vertical panel strips	100 L.F.	4	10
9	Installing beam ceilings 6 in. deep by 12 in. wide	100 L.F.	16	24
10	Installing from unassembled stock V-jointed wainscot, 2 ft. 6 in. to 4 ft. high	100 L.F.	16	20
11	Installing 4-ft. wainscot, made at the mill, sent knocked down	100 L.F.	16	30
12	Installing 4-ft. wainscot, paneled up at the mill	100 L.F.	12	24
13	Installing wainscot cap	100 L.F.	4	6
14	Erect plain piazza balustrade	100 L.F.	16	24
15	Assembling window frames at the job	Each	1	1
16	Installing single window frames in frame building	Each	1	1
17	Installing double window frames in frame building	Each	1	1
18	Installing single window frames in masonry building	Each	1	1
19	Installing double window frames in masonry building	Each	1¼	1½
20	Fitting and installing fixed sash	Each	½	1
21	Fitting and installing double sash with weights	Pair	1¼	1½
22	Fitting and installing French casement sash	Each	1½	1¾
23	Fitting and hanging outside blinds	Pair	1½	2
24	Placing interior trim around windows in frame building	Each	1½	2
25	Placing interior trim around windows in masonry building	Each	1¾	2½
26	Placing interior trim around window in masonry building with paneled jambs	Each	3½	6
27	Installing window complete in frame building including box frame, sash and trim	Each	3¾	4½
28	Installing window complete in masonry building including box frame, sash and trim	Each	4	5

LABOR TO INSTALL MILLWORK.—(*Continued*)

No.	Kind of work	Unit	Hours to do unit of work	
			Ordinary	First class
29	Setting single exterior door frame in frame building	Each	¾	1
30	Setting double exterior door frame in frame building	Each	1½	1¾
31	Setting single exterior door frame in masonry building	Each	1	1¾
32	Setting double exterior door frame in masonry building	Each	1½	2
33	Setting single interior door jambs in stud partition without transom	Each	1	1
34	Setting double interior door jambs in stud partition without transom	Each	1	1
35	Setting single interior door jambs in stud partition with transom	Each	1	1¼
36	Setting double interior door jambs in stud partition with transom	Each	1	1¾
37	Fit, hang and trim single exterior door with plain jambs	Each	4	5
38	Fit, hang and trim double exterior door with plain jambs	Pair	5½	6
39	Added time required for exterior door with paneled jambs	Each	2	3½
40	Fit hang and trim complete double vestibule door with sidelights and transom	Pair	10	12
41	Fit, hang and trim complete double vestibule door without sidelights and transom	Pair	6	8
42	Placing plain 1-member casing both sides of single interior door	Each	2	2½
43	Placing plain 2-member casing both sides of single interior door	Each	3	3½
44	Fit and hang complete transom sash including stop and lining	Each	1½	2
45	Fit and hang heavy wood slide door up to 4 by 8 ft	Each	6	8
46	Fit and hang heavy wood double slide doors 8 by 8 ft	Pair	10	16
47	Fit and hang heavy wood double slide doors 12 by 18 ft	Pair	16	20
48	Hanging toilet stall doors	Each	1	1½
49	Frame and erect ordered wood stairs, treads and risers not housed, railing not included	Story	20	24
50	Erecting ordered stairs made in shop ready to assemble, railing not included	Story	12	24
51	Same as above with landing	Story	16	30
52	Erect plain hand rail on brackets without newels or balusters	Story	2½	4
53	Erect railing with newels, hand-rail and balusters	Story	16	24

Labor to Set Millwork.—The time to do the various kinds of work specified in the foregoing tables is given under two general headings; viz.: "Ordinary" and "First Class." The time given in the column marked "Ordinary" is for a medium grade of work, and is such as is generally found in factories, tenement houses and the cheaper grade of apartment houses, flats, offices, schools, etc. The column marked "First class" is intended for good residences, court houses, post offices, hotels, high-grade office buildings and any other such buildings where first-class workmanship is required. Of course there are gradations between the two as well as extremes above or below either.

PRICE LIST OF MILLWORK

Through the courtesy of the Curtis Companies, we are inserting their list prices for certain kinds of millwork made by them. In using these list prices, it should be borne in mind that owing to the fluctuating market the prices shown should be used for rough estimating only. Sizes on sash shown are New York sizes. Western sizes are 1 in. wider, and Baltimore sizes ½ in. wider and ¼ in. longer. These sizes can usually be obtained at a slight advance in cost over those shown in the list. Generally only stock sizes for all items have been listed.

Packing Millwork.—Millwork is generally packed in bundles to prevent damage in shipment. Standard bundles usually contain the following:

Softwood Open and Panel Doors

3-0 by 7-0 and under

⅞ in. thick—10 to the bundle.
1⅛ in. thick— 8 to the bundle.
1⅜ in. thick— 6 to the bundle
1¾ in. thick— 5 to the bundle.

Softwood Glazed Doors

3-0 by 7-0 and under

1⅛ in. thick—6 to the bundle.
1⅜ in. thick—4 to the bundle.
1¾ in. thick—3 to the bundle.

Hardwood Open and Panel Doors

3-0 by 7-0 and under

1⅜ in. thick—4 to the bundle.
1¾ in. thick—3 to the bundle.

Garage Doors

Necessary doors to fill 8- by 8-ft. opening in one bundle.

Exterior Built-up Columns

Under 6 in. columns—6 to the crate.
6 to 8 in. columns—5 to the crate.
10 in. columns—4 to the crate.
12 in. columns—3 to the crate.

Windows and Sash

Check rail windows—6 to bundle.
Plain rail windows—8 to bundle.
Shutters—5 pair to the bundle.
1¾-in. single sash— 8 to the bundle.
1⅜-in. single sash—12 to the bundle.
1⅛-in. barn and cellar sash—12 to the bundle.

HARDWOOD GLAZED AND SLAB DOORS

3-0 by 7-0 and under

$1\frac{3}{8}$ in. thick—4 to the bundle.
$1\frac{3}{4}$ in. thick—3 to the bundle.

When shipped in less than carload lots a charge for packing is usually made which is as follows:

DOORS, 3-0 BY 7-0 AND UNDER	PER BUNDLE
Softwood open and panel doors	$0.68
Softwood laminated panel doors	1.32
Softwood glazed doors	1.32
Softwood and hardwood doors with long light	1.60
Hardwood panel doors	1.32
Hardwood glazed doors	1.32
Garage doors	1.32

DOORS, OVER 3-0 BY 7-0	PER SQUARE FOOT
Softwood panels doors	$0.04
Laminated panel and hardwood panel doors	0.08
Softwood and hardwood sash doors	$0.08
All long light doors	0.11

WINDOWS, SASH AND SHUTTERS	PER CRATE
Full bundles	No charge
Less than full bundles, windows or sash	$0.33
Open sash	0.33
Shutters less than full bundles	0.68

MOLDINGS	
Exterior moldings when ordered wrapped	$0.33

COLUMNS	PER BUNDLE
Exterior built-up columns	$0.68

FIG. 1.—Entrances and exterior doors.

A

Complete entrance includes frame, door, sidelight sash and transom. Complete frame includes sidelight panels and trim as illustrated.

DOOR

White Pine

DOOR SIZES		OVOLO MOLDED	FLUSH MOLDED
2–8 by 6–8	1⅜	$10.44	
3–0 by 6–8	1⅜	11.08	
2–8 by 7–0	1⅜	11.04	
3–0 by 7–0	1⅜	11.76	
2–8 by 6–8	1¾	14.28	$19.88
3–0 by 6–8	1¾	15.28	21.36
2–8 by 7–0	1¾	15.04	
3–0 by 7–0	1¾	16.16	

SIDELIGHT SASH—PER PAIR

0–10 by 4–5	1⅜	4 lt. W. P.	$2.72
0–10 by 4–9	1⅜	4 lt. W. P.	$2.88

TRANSOM SASH—EACH

4–9 by 1–3	1¾	16 lt. W. P.	$19.72
5–1 by 1–5½	1⅜	16 lt. W. P.	21.12

FRAME

White Pine with Oak Sill

3–0 by 7–0 door and under..... $79.88

B

DOOR FRAME

Complete entrance includes frame and door as illustrated.

Glass Size 3–0 by 7–0 Door
15 Lights 8¼ In. by 12⅝ In.

FRAME

White Pine with Oak Sill

3–0 by 7–0 door and under..... $10.44

DOOR SIZES		WHITE PINE D.S.	WHITE PINE PLAIN PLATE	PLAIN OAK D.S.	PLAIN OAK PLAIN PLATE	UNSELECTED BIRCH D.S.	UNSELECTED BIRCH PLAIN PLATE
2–8 by 6–8	1⅜	$14.56	$22.80				
3–0 by 6–8	1⅜	14.88	27.40				
2–8 by 7–0	1⅜	15.08	24.60				
3–0 by 7–0	1⅜	15.40	29.96				
2–8 by 6–8	1¾	17.20	25.60	$21.00	$28.56	$18.08	$25.64
3–0 by 6–8	1¾	17.52	30.20	21.96	33.72	18.92	30.64
2–8 by 7–0	1¾	17.72	27.40	21.80	30.60	18.76	27.56
3–0 by 7–0	1¾	18.04	32.76	22.80	36.56	19.56	33.32

C

SIDELIGHTS

Complete entrance includes frame, door, sidelights and molding at top of sidelight lock rail.

Glass Size 3–0 by 7–0 Door
1 Light 24 In. by 64 In.
White Pine

DOOR SIZES		D.S.	PLAIN PLATE	BEVEL PLATE
2–8 by 6–8	1⅜	$10.36	$27.48	$30.68
3–0 by 6–8	1⅜	11.16	31.88	35.52
2–8 by 7–0	1⅜	10.76	29.16	32.76
3–0 by 7–0	1⅜	11.76	33.88	37.84
2–8 by 6–8	1¾	12.84	30.00	33.20
3–0 by 6–8	1¾	13.60	34.44	38.08
2–8 by 7–0	1¾	13.24	31.72	35.32
3–0 by 7–0	1¾	14.24	36.40	40.40

Door Sizes		D.S.	Plain Plate	Bevel Plate
	Plain Oak			
2–8 by 6–8	1¾	$16.88	$34.76	$38.88
3–0 by 6–8	1¾	18.28	40.08	44.64
2–8 by 7–0	1¾	17.56	36.80	41.36
3–0 by 7–0	1¾	19.16	42.36	47.44

FRAME

White Pine, Oak Sill

3–0 by 7–0 door and under $25.56

SIDELIGHTS—PER PAIR

		White Pine			Plain Oak		
Door Sizes		D.S.	Plain Plate	Bevel Plate	D.S.	Plain Plate	Bevel Plate
1–0 by 6–8	1⅜	$ 9.60	$20.64	$23.72	$23.00	$36.04	$39.96
1–0 by 7–0	1⅜	10.24	22.92	26.36	24.44	39.36	43.72

D

Door and Frame

Complete entrance includes door and frame as illustrated.
Door is shipped without apron unless otherwise ordered.

Glass Size 3–0 by 7–0 Door
1 Light 27⅜ In. by 30 In.

Door Sizes	DOOR White Pine	D.S.
2–6 by 6–6	1⅜	$ 8.76
2–8 by 6–8	1⅜	9.16
3–0 by 6–8	1⅜	9.76
2–8 by 7–0	1⅜	9.80
3–0 by 7–0	1⅜	10.36
2–8 by 6–8	1¾	12.00
3–0 by 6–8	1¾	12.56
2–8 by 7–0	1¾	12.60
3–0 by 7–0	1¾	13.16
If apron is wanted add		0.36

This door has panels of standard thickness.

FRAME
White Pine
3–0 by 7–0 door and under $7.80

Fig. 2.—Garage doors.

A

In pairs 1¾ in. thick to fill opening 8–0 by 8–0

	White Pine
Price per pair, open	$29.32
Price per pair, glazed	32.28
Fir, Spruce or Emerwood	
Price per pair, open	$24.60
Price per pair, glazed	27.48

B

In sets of three doors 1¾ in. thick to fill opening 8–0 by 8–0

	White Pine
Price per set, open	$32.88
Price per set, glazed	36.24
Price per set, open	$28.24
Price per set, glazed	31.44

Interior Doors

White Pine—Ovolo Molded—Raised Panels

Sizes		
2–0 by 6–0	1⅜	$ 6.48
2–0 by 6–6	1⅜	6.79
2–0 by 6–8	1⅜	6.84
2–4 by 6–6	1⅜	7.40
2–4 by 6–8	1⅜	7.52
2–6 by 6–6	1⅜	7.72
2–6 by 6–8	1⅜	7.84
2–6 by 7–0	1⅜	8.40
2–8 by 6–8	1⅜	8.16
2–8 by 7–0	1⅜	8.72
3–0 by 6–8	1⅜	8.80
3–0 by 7–0	1⅜	9.44
2–6 by 6–6	1¾	11.00
2–6 by 6–8	1¾	11.20
2–6 by 7–0	1¾	12.04
2–8 by 6–8	1¾	11.80
2–8 by 7–0	1¾	12.60
3–0 by 6–8	1¾	12.80
3–0 by 7–0	1¾	13.86

Ovolo Molded—Flat Panels

Sizes		White Pine	Unselected Birch
2–0 by 6–0	1⅜	$ 6.36	$ 9.20
2–0 by 6–6	1⅜	6.64	9.36
2–0 by 6–8	1⅜	6.72	9.44
2–4 by 6–6	1⅜	7.20	9.80
2–4 by 6–8	1⅜	7.36	9.88
2–6 by 6–6	1⅜	7.52	10.12
2–6 by 6–8	1⅜	7.64	10.20
2–6 by 7–0	1⅜	8.16	10.92
2–8 by 6–8	1⅜	7.92	10.56
2–8 by 7–0	1⅜	8.48	11.32
3–0 by 7–0	1⅜	9.16	12.25
2–6 by 6–8	1¾	10.16	11.44
2–6 by 7–0	1¾	10.96	12.16
2–8 by 6–8	1¾	10.68	11.80
2–8 by 7–0	1¾	11.40	12.56
3–0 by 7–0	1¾	12.28	13.48

Interior Doors

White Pine—Raised Panels

Sizes		Ovolo Molded	Flush Molded
2–0 by 6–0	1⅜	$ 5.96	
2–0 by 6–6	1⅜	6.20	
2–0 by 6–8	1⅜	6.32	$10.48
2–4 by 6–6	1⅜	6.84	
2–4 by 6–8	1⅜	7.00	11.48
2–4 by 7–0	1⅜	7.52	12.44
2–6 by 6–6	1⅜	7.16	
2–6 by 6–8	1⅜	7.32	11.92
2–6 by 7–0	1⅜	7.84	
2–8 by 6–6	1⅜	7.48	
2–8 by 6–8	1⅜	7.64	12.48
2–8 by 7–0	1⅜	8.20	
3–0 by 6–8	1⅜	8.24	

White Pine—Raised Panels.—(*Continued*)

Sizes		Ovolo Molded	Flush Molded
3–0 by 7–0	1⅜	$ 8.92	
2–6 by 6–6	1¾	10.48	
2–6 by 6–8	1¾	10.68	
2–6 by 7–0	1¾	11.48	
2–8 by 6–8	1¾	11.28	$ 16.52
2–8 by 7–0	1¾	12.08	
3–0 by 6–8	1¾	12.24	17.80
3–0 by 7–0	1¾	13.20	

Ovolo Molded—Flat Panels

Sizes		White Pine	Unselected Birch
2–0 by 6–0	1⅜	$ 5.80	$ 9.04
2–0 by 6–6	1⅜	6.08	9.24
2–0 by 6–8	1⅜	6.16	9.28
2–4 by 6–6	1⅜	6.68	9.68
2–4 by 6–8	1⅜	6.80	9.72
2–6 by 6–6	1⅜	7.00	9.96
2–6 by 6–8	1⅜	7.08	10.04
2–6 by 7–0	1⅜	7.64	10.80
2–8 by 6–8	1⅜	7.40	10.40
2–8 by 7–0	1⅜	7.92	11.16
3–0 by 7–0	1⅜	8.60	12.12
2–6 by 6–8	1¾	9.60	11.28
2–6 by 7–0	1¾	10.36	12.04
2–8 by 6–8	1¾	10.08	11.64
2–8 by 7–0	1¾	10.80	12.40
3–0 by 7–0	1¾	11.68	13.36

Sizes

Interior Doors

Ovolo Molded—Laminated Flat Panels

White Pine Stiles and Rails, Yellow Pine Panels

Sizes		
2–0 by 6–0	1⅜	$ 5.68
2–0 by 6–6	1⅜	5.96
2–0 by 6–8	1⅜	6.08
2–4 by 6–6	1⅜	6.60
2–4 by 6–8	1⅜	6.72
2–4 by 7–0	1⅜	7.24
2–6 by 6–6	1⅜	6.92
2–6 by 6–8	1⅜	7.00
2–6 by 7–0	1⅜	7.56
2–8 by 6–8	1⅜	7.32
2–8 by 7–0	1⅜	7.88
3–0 by 6–8	1⅜	7.92
3–0 by 7–0	1⅜	8.60
2–6 by 6–8	1¾	9.56
2–6 by 7–0	1¾	10.36
2–8 by 6–8	1¾	10.04
2–8 by 7–0	1¾	10.80
3–0 by 6–8	1¾	10.84
3–0 by 7–0	1¾	11.72

Ovolo Molded—Laminated Flat Panels

White Pine Stiles and Rails

Sizes		Gum Panels	Birch Panels
2–0 by 6–0	1⅜	$ 5.76	$ 6.00
2–0 by 6–6	1⅜	6.04	6.32
2–0 by 6–8	1⅜	6.16	6.40
2–4 by 6–6	1⅜	6.68	6.96
2–4 by 6–8	1⅜	6.80	7.12
2–6 by 6–6	1⅜	7.00	7.32
2–6 by 6–8	1⅜	7.12	7.40
2–6 by 7–0	1⅜	7.68	8.00
2–8 by 6–8	1⅜	7.44	7.76
2–8 by 7–0	1⅜	8.00	8.32
3–0 by 7–0	1⅜	8.72	9.08
2–6 by 6–8	1¾	9.68	10.04
2–6 by 7–0	1¾	10.48	10.92
2–8 by 6–8	1¾	10.20	10.60
2–8 by 7–0	1¾	10.96	11.36
3–0 by 7–0	1¾	11.84	12.32

Interior Doors

Ovolo Molded—Laminated Flat Panels

Sizes		Plain Oak	Unselected Birch
2–0 by 6–0	1⅜	$11.04	$ 8.44
2–0 by 6–6	1⅜	11.28	8.60
2–0 by 6–8	1⅜	11.36	8.68
2–4 by 6–6	1⅜	11.84	9.04
2–4 by 6–8	1⅜	11.92	9.12
2–6 by 6–6	1⅜	12.24	9.36
2–6 by 6–8	1⅜	12.32	9.44
2–6 by 7–0	1⅜	13.32	10.16
3–0 by 6–8	1⅜	12.80	9.80
3–0 by 7–0	1⅜	13.80	10.56
2–8 by 6–8	1⅜	15.00	11.48
2–6 by 6–8	1¾	13.56	10.68
2–6 by 7–0	1¾	14.56	11.40
2–8 by 6–8	1¾	14.04	11.04
2–8 by 7–0	1¾	15.04	11.80
3–0 by 7–0	1¾	16.24	12.72

Ovolo Molded—Laminated Flat Panels

Sizes		Plain Oak
2–0 by 6–0	1⅜	$11.56
2–0 by 6–6	1⅜	11.80
2–0 by 6–8	1⅜	11.92
2–0 by 7–0	1⅜	12.88
2–4 by 6–8	1⅜	12.48
2–4 by 7–0	1⅜	13.44
2–6 by 6–6	1⅜	12.80
2–6 by 6–8	1⅜	12.88
2–6 by 7–0	1⅜	13.84
2–8 by 6–8	1⅜	13.36
3–0 by 6–6	1⅜	14.52
3–0 by 6–8	1⅜	14.60
3–0 by 7–0	1⅜	15.56

Interior Doors

Ovolo Molded—Flat Panels

White Pine—Yellow Pine Panels

Sizes		
2-0 by 6-0	1⅜	$ 6.28
2-0 by 6-6	1⅜	6.56
2-0 by 6-8	1⅜	6.68
2-4 by 6-6	1⅜	7.24
2-4 by 6-8	1⅜	7.40
2-6 by 6-6	1⅜	7.60
2-6 by 6-8	1⅜	7.72
2-6 by 7-0	1⅜	8.32
2-8 by 6-8	1⅜	8.04
2-8 by 7-0	1⅜	8.68
3-0 by 7-0	1⅜	9.44
2-6 by 6-8	1¾	10.44
2-6 by 7-0	1¾	11.32
2-8 by 6-8	1¾	11.00
2-8 by 7-0	1¾	11.80
3-0 by 7-0	1¾	12.80

Ovolo Molded—Flat Panels

Sizes		Plain Oak	Unselected Birch
2-0 by 6-0	1⅜	$12.12	$ 9.52
2-0 by 6-6	1⅜	12.36	9.68
2-0 by 6-8	1⅜	12.44	9.76
2-4 by 6-6	1⅜	12.92	10.16
2-4 by 6-8	1⅜	13.00	10.20
2-4 by 7-0	1⅜	14.00	
2-6 by 6-6	1⅜	13.32	10.48
2-6 by 6-8	1⅜	13.40	10.52
2-6 by 7-0	1⅜	14.40	11.28
2-8 by 6-8	1⅜	13.92	10.92
2-8 by 7-0	1⅜	14.88	11.68
3-0 by 7-0	1⅜	16.12	12.64
2-6 by 6-8	1¾	14.64	11.76
2-6 by 7-0	1¾	15.64	12.52
2-8 by 6-8	1¾	15.16	12.16
2-8 by 7-0	1¾	16.12	11.92
3-0 by 7-0	1¾	17.36	13.88

Interior Doors

Ovolo Molded—Flat Panels

White Pine—Yellow Pine Panels

Sizes		
2–0 by 6–0	1⅜	$ 6.20
2–0 by 6–6	1⅜	6.48
2–0 by 6–8	1⅜	6.60
2–4 by 6–6	1⅜	7.16
2–4 by 6–8	1⅜	7.28
2–6 by 6–6	1⅜	7.48
2–6 by 6–8	1⅜	7.60
2–6 by 7–0	1⅜	8.20
2–8 by 6–8	1⅜	7.92
2–8 by 7–0	1⅜	8.56
3–0 by 7–0	1⅜	9.32
2–6 by 6–6	1¾	10.16
2–6 by 6–8	1¾	10.32
2–6 by 7–0	1¾	11.16
2–8 by 6–8	1¾	10.84
2–8 by 7–0	1¾	11.68
3–0 by 7–0	1¾	12.64

Ovolo Molded—Flat Panels

Sizes		Plain Oak	Unselected Birch
2–0 by 6–0	1¾	$13.36	$10.84
2–0 by 6–6	1¾	13.64	11.04
2–0 by 6–8	1¾	13.72	11.12
2–4 by 6–6	1¾	14.20	11.52
2–4 by 6–8	1¾	14.28	11.56
2–6 by 6–6	1¾	14.60	11.84
2–6 by 6–8	1¾	14.68	11.88
2–6 by 7–0	1¾	15.68	12.68
2–8 by 6–8	1¾	15.20	12.28
2–8 by 7–0	1¾	16.20	13.08
3–0 by 7–0	1¾	17.44	14.04

Interior Doors

Ovolo Molded—Flat Panels

White Pine—Yellow Pine Panels

Sizes		
2–0 by 6–0	1⅜	$ 6.28
2–0 by 6–6	1⅜	6.56
2–0 by 6–8	1⅜	6.68
2–4 by 6–6	1⅜	7.24
2–4 by 6–8	1⅜	7.40
2–6 by 6–6	1⅜	7.60
2–6 by 6–8	1⅜	7.72
2–6 by 7–0	1⅜	8.32
2–8 by 6–8	1⅜	8.04
2–8 by 7–0	1⅜	8.68
3–0 by 7–0	1⅜	9.44
2–6 by 6–8	1¾	10.44
2–6 by 7–0	1¾	11.32
2–8 by 6–8	1¾	11.00
2–8 by 7–0	1¾	11.80
3–0 by 7–0	1¾	12.80

Ovolo Molded—Flat Panels

Sizes		Plain Oak	Unselected Birch
2–0 by 6–0	1⅜	$11.88	$ 9.52
2–0 by 6–6	1⅜	12.12	9.72
2–0 by 6–8	1⅜	12.20	9.80
2–4 by 6–6	1⅜	12.68	10.20
2–4 by 6–8	1⅜	12.80	10.24
2–6 by 6–6	1⅜	13.12	10.52
2–6 by 6–8	1⅜	13.20	10.56
2–6 by 7–0	1⅜	14.16	11.36
2–8 by 6–8	1⅜	13.68	10.96
2–8 by 7–0	1⅜	14.64	11.76
3–0 by 7–0	1⅜	15.88	12.72
2–6 by 6–8	1¾	14.44	11.80
2–6 by 7–0	1¾	15.40	12.60
2–8 by 6–8	1¾	14.92	12.20
2–8 by 7–0	1¾	15.88	13.00
3–0 by 7–0	1¾	17.12	13.96

Interior Doors

Ovolo Molded—Flat Panels

White Pine—Yellow Pine Panels

Sizes		
2–0 by 6–0	1⅜	$ 6.28
2–0 by 6–6	1⅜	6.56
2–0 by 6–8	1⅜	6.68
2–4 by 6–6	1⅜	7.24
2–4 by 6–8	1⅜	7.40
2–6 by 6–6	1⅜	7.60
2–6 by 6–8	1⅜	7.72
2–6 by 7–0	1⅜	8.32
2–8 by 6–8	1⅜	8.04
2–8 by 7–0	1⅜	8.68
3–0 by 7–0	1⅜	9.44
2–6 by 6–8	1¾	10.44
2–6 by 7–0	1¾	11.32
2–8 by 6–8	1¾	11.00
2–8 by 7–0	1¾	11.80
3–0 by 7–0	1¾	12.80

Ovolo Molded—Flat Panels

Sizes		Plain Oak	Unselected Birch
2–0 by 6–0	1⅜	$11.36	$ 8.84
2–0 by 6–6	1⅜	11.60	9.04
2–0 by 6–8	1⅜	11.68	9.08
2–4 by 6–6	1⅜	12.16	9.44
2–4 by 6–8	1⅜	12.24	9.52
2–6 by 6–6	1⅜	12.52	9.76
2–6 by 6–8	1⅜	12.60	9.80
2–6 by 7–0	1⅜	13.52	10.52
2–8 by 6–8	1⅜	13.08	10.16
2–8 by 7–0	1⅜	14.00	10.88
3–0 by 7–0	1⅜	15.16	11.80
2–6 by 6–8	1¾	13.84	11.04
2–6 by 7–0	1¾	14.76	11.76
2–8 by 6–8	1¾	14.32	11.40
2–8 by 7–0	1¾	15.24	12.12
3–0 by 7–0	1¾	16.40	13.04

Interior Doors

O. G. Molded—Raised Panels

Sizes		White Pine No. 1	White Pine with Y. P. Panels
2– 0 by 6– 0	1⅛	$ 4.84	
2– 0 by 6– 0	1⅜	5.36	$ 5.52
2– 0 by 6– 6	1⅜	5.64	5.80
2– 0 by 6– 8	1⅜	5.72	5.88
2– 0 by 7– 0	1⅜	6.20	6.40
2– 4 by 6– 4	1⅜	6.20	6.40
2– 4 by 6– 6	1⅜	6.20	6.40
2– 4 by 6– 8	1⅜	6.36	6.52
2– 4 by 7– 0	1⅜	6.84	7.04
2– 6 by 6– 6	1⅜	6.52	6.72
2– 6 by 6– 8	1⅜	6.60	6.80
2– 6 by 7– 0	1⅜	7.16	7.36
2– 8 by 6– 8	1⅜	6.92	7.16
2– 8 by 7– 0	1⅜	7.48	7.72
2–10 by 6–10	1⅜	7.72	7.92
3– 0 by 6– 8	1⅜	7.52	7.76
3– 0 by 7– 0	1⅜	8.16	8.40
2– 6 by 7– 0	1¾	9.88	10.16
2– 8 by 6– 8	1¾	9.60	9.84
2– 8 by 7– 0	1¾	10.32	10.60
2–10 by 6–10	1¾	10.60	10.92
3– 0 by 6– 8	1¾	10.36	10.64
3– 0 by 7– 0	1¾	11.20	11.52

O. G. Molded—Raised Panels

Sizes		White Pine No. 2
2– 0 by 6– 0	1⅛	$4.64
2– 0 by 6– 0	1⅜	5.08
2– 0 by 6– 6	1⅜	5.36
2– 0 by 6– 8	1⅜	5.44
2– 0 by 7– 0	1⅜	5.88
2– 4 by 6– 4	1⅜	5.88
2– 4 by 6– 6	1⅜	5.88
2– 4 by 6– 8	1⅜	6.04
2– 4 by 7– 0	1⅜	6.48
2– 6 by 6– 0	1⅜	5.88
2– 6 by 6– 6	1⅜	6.20

O. G. Molded—Raised Panels.—(*Continued*)

Sizes		White Pine No. 2
2– 6 by 6– 8	1⅜	$6.32
2– 6 by 7– 0	1⅜	6.80
2– 8 by 6– 0	1⅜	6.16
2– 8 by 6– 8	1⅜	6.56
2– 8 by 7– 0	1⅜	7.12
2–10 by 6–10	1⅜	7.36
3– 0 by 6– 8	1⅜	7.16
3– 0 by 7– 0	1⅜	7.76

Interior Doors

4 Panel O. G.

Sizes		No. 1 Quality
2– 0 by 6– 0	¾	$4.32
2– 0 by 6– 0	1⅛	4.84
2– 6 by 6– 6	1⅛	5.84
2– 8 by 6– 6	1⅛	6.24
2– 8 by 6– 8	1⅛	6.24
2– 0 by 6– 0	1⅜	5.36
2– 0 by 6– 6	1⅜	5.64
2– 0 by 6– 8	1⅜	5.72
2– 4 by 6– 4	1⅜	6.20
2– 4 by 6– 6	1⅜	6.20
2– 4 by 6– 8	1⅜	6.36
2– 6 by 6– 0	1⅜	6.20
2– 6 by 6– 6	1⅜	6.52
2– 6 by 6– 8	1⅜	6.60
2– 6 by 7– 0	1⅜	7.16
2– 8 by 6– 0	1⅜	6.48
2– 8 by 6– 6	1⅜	6.80
2– 8 by 6– 8	1⅜	6.92
2– 8 by 7– 0	1⅜	7.48
2–10 by 6–10	1⅜	7.72
3– 0 by 6– 8	1⅜	7.52
3– 0 by 7– 0	1⅜	8.16

4 Panel O. G.

Sizes		No. 2 Quality
2– 0 by 6– 0	$\frac{3}{4}$	$4.08
2– 0 by 6– 0	$1\frac{1}{8}$	4.64
2– 0 by 6– 6	$1\frac{1}{8}$	4.80
2– 6 by 6– 6	$1\frac{1}{8}$	5.56
2– 8 by 6– 6	$1\frac{1}{8}$	5.92
2– 8 by 6– 8	$1\frac{1}{8}$	5.92
2– 0 by 6– 0	$1\frac{3}{8}$	5.08
2– 0 by 6– 6	$1\frac{3}{8}$	5.36
2- 0 by 6– 8	$1\frac{3}{8}$	5.44
2– 4 by 6– 4	$1\frac{3}{8}$	5.88
2– 4 by 6– 6	$1\frac{3}{8}$	5.88
2- 4 by 6– 8	$1\frac{3}{8}$	6.04
2 6 by 6– 0	$1\frac{3}{8}$	5.88
2– 6 by 6– 6	$1\frac{3}{8}$	6.20
2– 6 by 6– 8	$1\frac{3}{8}$	6.32
2– 6 by 7– 0	$1\frac{3}{8}$	6.80
2– 8 by 6– 0	$1\frac{3}{8}$	6.16
2– 8 by 6– 6	$1\frac{3}{8}$	6.48
2– 8 by 6– 8	$1\frac{3}{8}$	6.56
2– 8 by 7– 0	$1\frac{3}{8}$	7.12
2–10 by 6–10	$1\frac{3}{8}$	7.36
3– 0 by 7– 0	$1\frac{3}{8}$	7.76

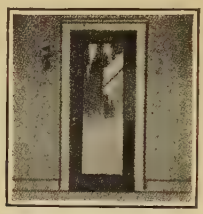


FIG. 3.—Mirror doors.

Any standard panel arrangement on reverse side

Mirror Size
2–8 by 6–8 Door
22 In. by 66 In.

White Pine

Sizes		Plain Plate Mirror	Bevel Plate Mirror
2–0 by 6–6	1¾	$34.36	$38.48
2–4 by 6–6	1¾	39.92	44.04
2–6 by 6–6	1¾	42.56	46.72
2–6 by 6–8	1¾	43.56	47.84
2–6 by 7–0	1¾	46.04	50.56
2–8 by 6–8	1¾	49.64	55.32

Plain Oak

2–0 by 6–6	1¾	$41.92	$46.60
2–4 by 6–6	1¾	48.84	53.48
2–6 by 6–6	1¾	52.20	56.88
2–6 by 6–8	1¾	53.28	58.12
2–6 by 7–0	1¾	56.20	61.36
2–8 by 6–8	1¾	60.00	66.44

Unselected Birch

2–0 by 6–6	1¾	$39.08	$43.76
2–4 by 6–6	1¾	45.80	50.48
2–6 by 6–6	1¾	49.08	53.84
2–6 by 6–8	1¾	50.16	54.96
2–6 by 7–0	1¾	52.80	57.96
2–8 by 6–8	1¾	56.76	63.20

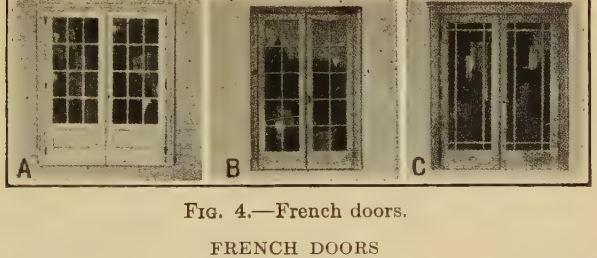


FIG. 4.—French doors.

FRENCH DOORS

A

PRICED PER PAIR SIZES		White Pine Laminated Flat Panels D.S.	PLAIN PLATE	BEVEL PLATE
4–0 by 6–8	1⅜	$18.84	$33.32	$42.60
4–0 by 7–0	1⅜	20.00	34.12	43.64
5–0 by 6–8	1⅜	23.48	43.88	58.12
5–0 by 7–0	1⅜	24.72	44.88	59.16
4–0 by 6–8	1¾	24.08	38.68	48.20
4–0 by 7–0	1¾	25.24	39.68	49.20
5–0 by 6–8	1¾	28.72	49.44	63.72
5–0 by 7–0	1¾	29.96	50.44	64.72
		Plain Oak		
4–0 by 6–8	1¾	$38.32	$53.08	$65.44
4–0 by 7–0	1¾	40.52	55.04	67.36
5–0 by 6–8	1¾	45.60	66.92	85.40
5–0 by 7–0	1¾	47.88	68.84	87.36
		Unselected Birch		
4–0 by 6–8	1¾	$32.76	$47.52	$59.84
4–0 by 7–0	1¾	34.68	49.20	61.52
5–0 by 6–8	1¾	39.32	60.64	79.12
5–0 by 7–0	1¾	41.20	62.16	80.64

For Astragal, Add:
White Pine 1⅜, $0.80—1¾, $0.88
Hardwood 1¾, $1.32
Each Door for 4–0 Opening has 8 Lights, 2 Wide
Each Door for 5–0 Opening has 12 Lights, 3 Wide

Glass Sizes
2–0 by 7–0 8 Lights 8 In. by 14 In.
2–6 by 7–0 12 Lights 7⅛ In. by 14 In.

B

PRICED PER PAIR SIZES		White Pine D.S.	PLAIN PLATE	BEVEL PLATE
4–0 by 6–8	1⅜	$21.68	$38.80	$50.68
4–0 by 7–0	1⅜	22.56	39.76	51.60
5–0 by 6–8	1⅜	27.32	51.96	69.80
5–0 by 7–0	1⅜	28.04	52.72	70.56
4–0 by 6–8	1¾	26.92	44.36	56.28
4–0 by 7–0	1¾	27.80	45.28	57.20
5–0 by 6–8	1¾	32.56	57.52	75.36
5–0 by 7–0	1¾	33.28	58.28	76.12
		Plain Oak		
4–0 by 6–8	1¾	$31.28	$46.68	$59.96
4–0 by 7–0	1¾	32.56	47.96	61.20
5–0 by 6–8	1¾	38.52	60.80	80.72
5–0 by 7–0	1¾	39.76	62.08	82.04
		Unselected Birch		
4–0 by 6–8	1¾	$27.32	$42.68	$55.96
4–0 by 7–0	1¾	28.44	43.80	57.08
5–0 by 6–8	1¾	33.80	56.12	76.04
5–0 by 7–0	1¾	34.76	52.04	77.00

For Astragal, Add:
White Pine 1⅜, $0.80—1¾, $0.88
Hardwood 1¾, $1.32

Each Door for 4–0 Opening has 10 Lights, 2 Wide
Each Door for 5–0 Opening has 15 Lights, 3 Wide

Glass Sizes

2–0 by 7–0 10 Lights 8 In. by 14 In.
2–6 by 7–0 15 Lights 7⅛ In. by 14 In.

C

White Pine

Priced per Pair Sizes		D.S.	Plain Plate	Bevel Plate
4–0 by 6–8	1⅜	$22.68	$46.76	$62.80
4–0 by 7–0	1⅜	24.12	53.44	69.52
5–0 by 6–8	1⅜	24.76	59.36	75.84
5–0 by 7–0	1⅜	26.72	65.44	83.28
4–0 by 6–8	1¾	27.92	52.32	67.36
4–0 by 7–0	1¾	29.40	59.00	75.08
5–0 by 6–8	1¾	30.00	64.92	81.40
5–0 by 7–0	1¾	32.00	71.00	88.84
Plain Oak				
4–0 by 6–8	1¾	$35.40	$58.60	$76.52
4–0 by 7–0	1¾	37.40	65.76	84.88
5–0 by 6–8	1¾	38.64	72.28	91.88
5–0 by 7–0	1¾	41.16	78.80	100.04
Unselected Birch				
4–0 by 6–8	1¾	$30.96	$54.16	$72.08
4–0 by 7–0	1¾	32.80	61.16	80.28
5–0 by 6–8	1¾	34.04	67.69	87.28
5–0 by 7–0	1¾	36.24	73.88	95.16

For Astragal, Add:
White Pine 1⅜, $0.80—1¾, $0.88
Hardwood 1¾, $1.32

Glass Sizes

2–6 by 7–0 door.

4 Lights 4 In. by 4 In.
2 Lights 4 In. by 59⅛ In.
2 Lights 4 In. by 13¾ In.
1 Light 13¾ In. by 63⅛ In.

Fig. 5.—Bedroom slat doors.

Sizes		White Pine
2–6 by 6–8	1⅜	$23.96
2–8 by 6–8	1⅜	24.40

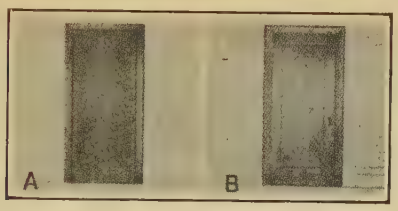


FIG. 6.—Interior slab doors.

Sizes		A Plain Oak	A Unsel. Birch	Sizes		B Plain Oak	B Unsel. Birch
2–8 by 6–8	1¾....	$27.68	$25.56	2–8 by 6–8	1¾....	$23.44	$21.32
2–8 by 7–0	1¾....	28.76	26.52	2–8 by 7–0	1¾....	24.52	22.28
3–0 by 6–8	1¾....	30.32	27.88	3–0 by 6–8	1¾....	26.08	23.64
3–0 by 7–0	1¾....	31.48	28.92	3–0 by 7–0	1¾....	27.24	24.68
				If inlaid one side only, deduct...			$2.12

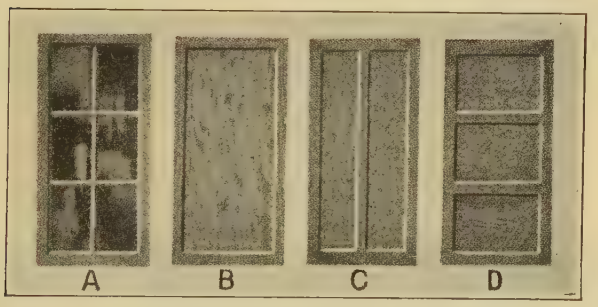


FIG. 7.—Cupboard doors.

Ovolo Molded, carried in White Pine with Yellow Pine Panels only

Sizes	A 1⅛—Glazed D.S.	B 1⅛—One Panel
1–3⅛ by 1–10⅞	$3.08	$2.24
1–3¾ by 2– 3½	3.28	2.36
1–3¾ by 2– 8⅜	3.36	2.96

C and D

Sizes	¾ In.	1⅛ In.	Sizes	¾ In.	1⅛ In.
1–4 by 2–0	$1.32	$1.44	1–8 by 2–6	$1.80	$2.00
1–4 by 2–6	1.68	1.88	1–8 by 3–0	2.00	2.16
1–4 by 3–0	1.80	2.04	1–8 by 4–0	2.52	2.72
1–4 by 4–0	2.32	2.56	2–0 by 2–0	1.56	1.72
1–6 by 2–0	1.36	1.48	2–0 by 2–6	2.00	2.20
1–6 by 2–6	1.72	1.92	2–0 by 3–0	2.16	2.36
1–6 by 3–0	1.88	2.08	2–0 by 4–0	2 76	3 00
1–6 by 4–0	2.36	2.60	2–0 by 4–6	3 20	3.48
1–8 by 2–0	1.44	1.56	2–0 by 5–0	3.36	3.68

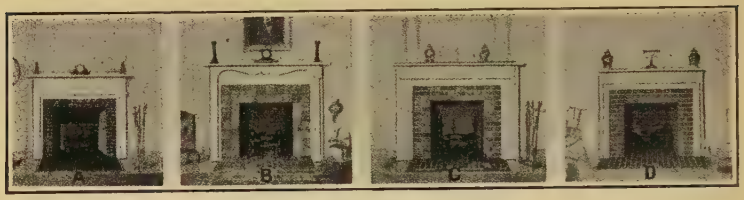


FIG. 8.—Mantels.

	A	B
Height to top of shelf	3 ft. 10⅝ in.	4 ft. 3½ in.
Length overall of shelf	4 ft. 8¼ in.	5 ft. 4½ in.
Width of shelf	4 13/16 in.	9 in.
Height of brick opening	2 ft. 10 in.	
Width of brick opening	3 ft. 3 in.	
Height of tile opening	.....	3 ft. 3½ in.
Width of tile opening	.....	3 ft. 11 in.
Unselected birch	$30.92	$50.28

	C	D
Height to top of shelf	4 ft. 4⅝ in.	4 ft. 2⅞ in.
Length overall of shelf	5 ft. 9¾ in.	4 ft. 6¾ in.
Width of shelf	6⅜ in.	6⅜ in.
Height of brick opening	3 ft. 3½ in.	3 ft. 3½ in.
Width of brick opening	3 ft. 11 in.	3 ft. 8 in.
Yellow pine	.....	$31.32
Unselected birch	$35.24	33.28

FIG. 9.—Paneled wainscoting and paneling.

A	B
Height of paneling from finished floor to top of cap, 3 ft. 7 in.	Height of paneling from finished floor to top of cap, 2 ft. 7 in.
A Flush molded. Flat panels, per sq. ft	Unselected birch, $2.08
B Flush molded. Flat panels, per sq. ft	Unselected birch, $2.08

C	D
Paneling extends from floor to ceiling. Finished at top with angle cornice.	Height of paneling from finished floor to top of cap, 3 ft. 7 in.
C Flush molded. Flat panels, per sq. ft	Plain oak $2.40
D Square sticking. Flat panels, per sq. ft.:	
	Plain oak, $2.00. Unselected Birch, $2.00

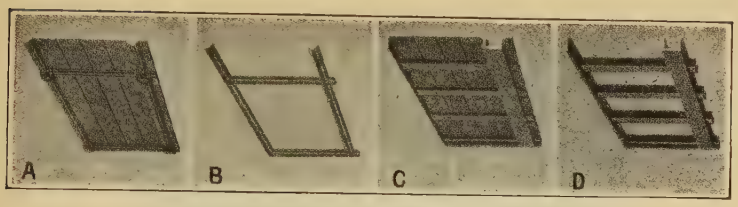


FIG. 10.—Ceiling beams—K. D.

MEMBERS	A		B	
	PLAIN OAK	UNSEL. BIRCH	PLAIN OAK	UNSEL. BIRCH
Main beam, per lineal foot	$0.33	$0 33	$0.33	$0.33
Wall beam, per lineal foot	0.23	0.23	0.23	0.23
V-joint ceiling, per square foot	0.49	0.49		
Intersection blocks, each	1.04	1.04		

MEMBERS	C		D	
	PLAIN OAK	UNSEL. BIRCH	PLAIN OAK	UNSEL. BIRCH
Main beam, per lineal foot	$0.64	$0.64	$0.67	$0.67
Wall beam, per lineal foot	0.36	0.36	0.40	0.40
Cross beam, per lineal foot	0.36	0.36	0.40	0.40
Wall frieze, per lineal foot	0.21	0.21	0.22	0.22
V-joint ceiling, per square foot	0.49	0.49		

Prices include the necessary quarter round with each member.

FIG. 11.—Medicine cases.

A requires a rough opening 1 ft. 9½ in. by 2 ft. 6¼ in. by 4½ in. The size of the compartment below the mirror is 1 ft. 7⅜ in. by 4¼ in. by 5 ⅛ in. Size of mirror, 16 in. by 20 in.

White pine, with plain plate mirror $14.04

B requires a rough opening 1 ft. 9½ in. by 2 ft. 1½ in. by 4½ in. Size of mirror, 16 in. by 20 in.

White pine, with plain plate mirror $13.36
Unselected birch, with plain plate mirror $14.20

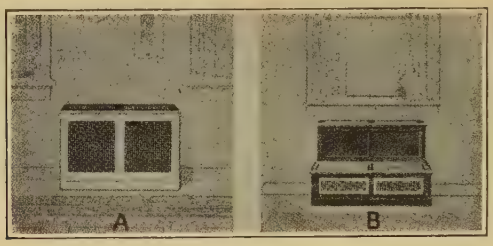


Fig. 12.—Radiator enclosures.

These enclosures are furnished with $\frac{3}{16}$ in. iron grills, drilled and counter-sunk ready to put in place as finished. Made in various widths to accommodate various lengths. A furnished with hinged-top seat.

Design	Plain Oak	Unsel. Birch
A	$48.92	$48.60
B	44.16	43.72

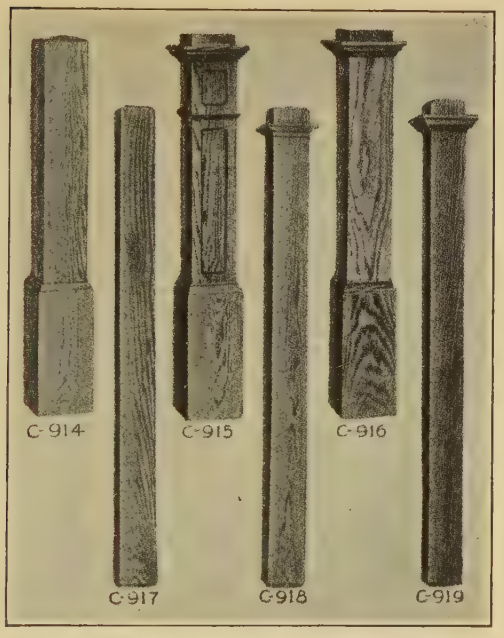


FIG. 13.—Stair newels.

DESIGN		SIZES	YELLOW PINE EACH	PLAIN OAK EACH
C-914	Starting Newel	6 by 6 in. by 4 ft. 6 in.	$ 8.04	$ 9.28
C-915	Starting Newel	6 by 6 in. by 4 ft. 6 in.	12.88	14.48
C-916	Starting Newel	6 by 6 in. by 4 ft. 6 in.	8.44	10.00
C-917	Angle Newel	5 by 5 in. by 5 ft. 8 in.	6.48	7.72
C-918	Angle Newel	5 by 5 in. by 5 ft. 8 in.	7.52	8.96
C-919	Angle Newel	5 by 5 in. by 5 ft. 8 in.	7.52	8.96

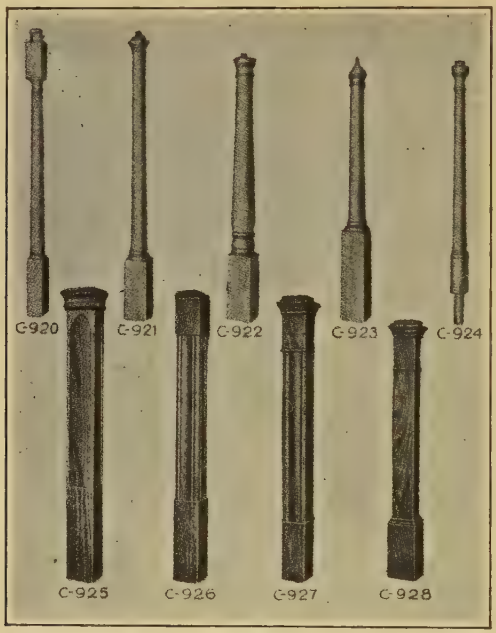


FIG. 14.—Stair newels.

DESIGN	SIZES	YELLOW PINE EACH	PLAIN OAK EACH	UNSEL. BIRCH EACH
C-920	2½ by 2½ in. by 3 ft. 5 in.	.....	.....	$4.32
C-921	3½ by 3¼ in. by 3 ft. 2 in.	.....	.....	5.08
C-922	3½ by 3½ in. by 3 ft. 2 in.	.....	.....	4.80
C-923	3½ by 3½ in. by 3 ft. 3 in.	.....	.....	4.64
C-924	2½ by 2½ in. by 2 ft. 7½ in.	.....	.....	3.72
C-925	4 by 4 in. by 3 ft. 6 in.	$6.88	$7.52	7.52
C-926	3¾ by 3¾ in. by 3 ft. 6 in.	6.32	6.92	6.92
C-927	3½ by 3½ in. by 3 ft. 5 in.	6.72	7.28	7.28
C-928	3½ by 3½ in. by 3 ft. 5 in.	5.92	6.64	6.64

Prices of designs C-921, C-922, and C-923 do not include newel cap.

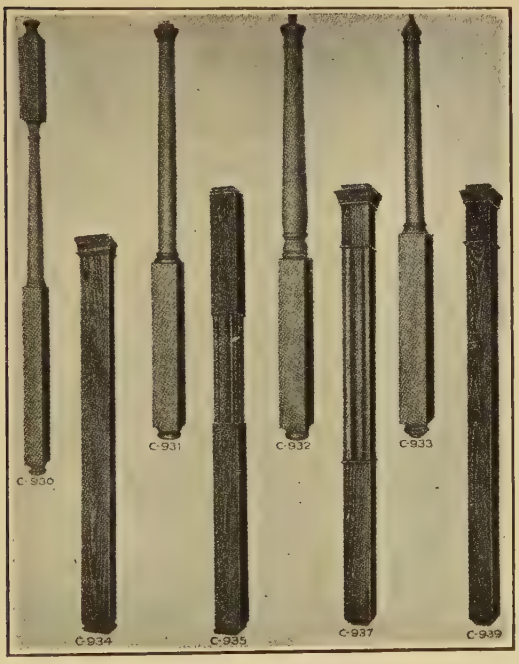


FIG. 15.—Stair newels.

DESIGN	SIZES	YELLOW PINE EACH	PLAIN OAK EACH	UNSEL. BIRCH EACH
C-930	2½ in. by 2½ in. by 5 ft. 2 in.	.....	.....	$4.56
C-931	3¼ in. by 3¼ in. by 4 ft. 10 in.	.....	.....	6.24
C-932	3½ in. by 3½ in. by 4 ft. 10 in.	.....	.....	6.20
C-933	3½ in. by 3½ in. by 4 ft. 9 in.	.....	.....	6.56
C-934	4 in. by 4 in. by 4 ft. 8 in.	$5.76	$6.76	
C-935 for landing only	3¾ in. by 3¾ in. by 4 ft. 7 in.	.....	9.00	
C-936 like C-936, for angle only	3¾ in. by 3¾ in. by 5 ft. 2 in.	8.32	9.20	9.20
C-937 for landing only	3½ in. by 3½ in. by 4 ft. 7 in.	8.56	9.36	9.36
C-938 like C-937, for angle only	3½ in. by 3½ in. by 5 ft. 2 in.	8.64	9.52	9.52
C-939	3½ in. by 3½ in. by 5 ft. 2 in.	6.16	7.08	7.08

All but C-935, C-936 C-937 and C-938 may be used as either landing or angle newels. Prices of designs C-931, C-932 and C-933 do not include newel cap.

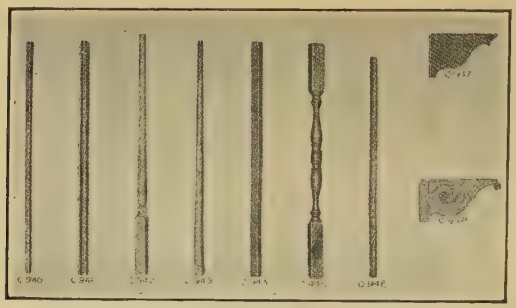


FIG. 16.—Stair parts.

BALUSTERS

DESIGN	SIZES	YELLOW PINE EACH	PLAIN OAK EACH	UNSEL. BIRCH EACH
C-940...	$\frac{5}{8}$ in. by $1\frac{3}{16}$ in. by 2 ft. 6 in.	.....	.....	$0.13
	$\frac{5}{8}$ in. by $1\frac{3}{16}$ in. by 2 ft. 9 in.	.....	.....	0.13
C-941...	$1\frac{1}{8}$ in. by $1\frac{1}{8}$ in. by 2 ft. 6 in. molded	.....	.....	0.19
	$1\frac{1}{8}$ in. by $1\frac{1}{8}$ in. by 2 ft. 9 in. molded	.....	.....	0.19
	$1\frac{3}{8}$ in. by 2 ft. 7 in. turned	.....	.....	0.48
C-942...	$1\frac{3}{8}$ in. by 2 ft. 9 in. turned	.....	.....	0.48
C-943...	$1\frac{1}{4}$ in. by 2 ft. 6 in. turned	.....	.....	0.48
	$1\frac{1}{4}$ in. by 2 ft. 9 in. turned	.....	.....	0.48
C-944...	$1\frac{1}{8}$ in. by $1\frac{1}{8}$ in. by 2 ft. 4 in.	$0.13	$0.19	0.19
	$1\frac{1}{8}$ in. by $1\frac{1}{8}$ in. by 2 ft. 6 in.	0.13	0.19	0.19
	$1\frac{1}{8}$ in. by $1\frac{1}{8}$ in. by 2 ft. 9 in.	0.13	0.19	0.19
	$1\frac{3}{8}$ in. by $1\frac{3}{8}$ in. by 2 ft. 8 in.	0.16	0.26	0.26
	$1\frac{3}{4}$ in. by $1\frac{3}{4}$ in. by 2 ft. 8 in.	0.26	0.39	0.39
C-945...	$1\frac{5}{8}$ in. by $1\frac{5}{8}$ in. by 2 ft. 4 in. turned	0.60	0.69	
	$1\frac{5}{8}$ in. by $1\frac{5}{8}$ in. by 2 ft. 6 in. turned	0.60	0.69	
C-946...	$1\frac{1}{8}$ in. by 1 ft. 11 in. round	.....	0.17	0.17

BRACKETS

DESIGN	SIZES	EACH	EACH	EACH
C-947	$9\frac{5}{8}$ in. by $5\frac{1}{4}$ in. by $\frac{3}{8}$ in.	.....	.....	$0.22
C-948	$10\frac{3}{4}$ in. by $6\frac{1}{4}$ in. by $\frac{5}{8}$ in.	.....	.....	0.48

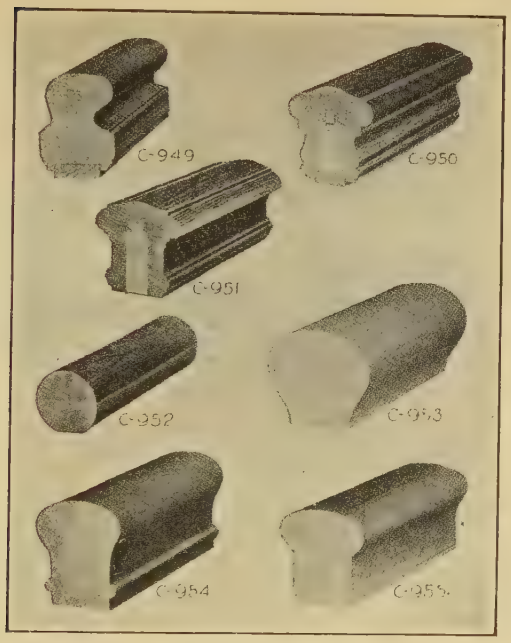


FIG. 17.—Stair rail.

DESIGN	RAIL SIZES	PER FT.	PER FT.	PER FT.
C-949	2¾ in. by 3½ in.	$0.39	$0.54	
C-950	3 in. by 3⅛ in.	0.35	0.56	$0.56
C-951	3⅛ in. by 3 in.	0.32	0.56	0.56
C-952	2⅛ in. by 2 in.	0.19	0.26	0.26
C-953	2⅛ in. by 2¾ in.	0.24	0.37	0.37
C-954	2¼ in. by 2⅜ in.	0.24	0.35	0.35
C-955	2½ in. by 2¼ in.	0.24	0.35	0.35

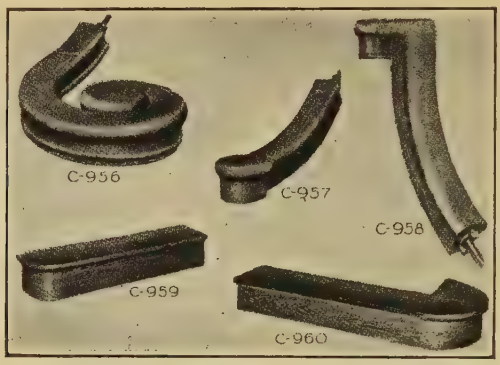


FIG. 18.—Stair parts.

MISCELLANEOUS PARTS

	EACH	EACH	EACH
Newel cap to match any Curtis rail fitted to rail or crook	.....	.....	$ 2.16
Newel cap to match any Curtis rail not fitted	.....	.....	1.08
C-956 Volute to match any Curtis rail	.....	.....	16.60
C-957 Easing to match any Curtis rail, without newel cap	.....	$ 5.12	5.12
C-958 Gooseneck to match any Curtis rail	.....	10.92	10.92
C-959 Quarter Circle Tread	$10.44	11.24	11.24
C-960 Half Circle Tread	11.92	13.16	13.16

Windows

Two-light Check Rail 1⅜ In.

Glass Sizes	Opening Sizes	Open	S.S.	D.S.
12 by 20	1– 4 by 3–10	$1.17		
12 by 24	4– 6	1.25		
16 by 16	1– 8 by 3– 2	1.17		
16 by 20	3–10	1.25		
16 by 24	4– 6	1.32		
18 by 20	1–10 by 3–10	1.29		
18 by 24	4– 6	1.36		
20 by 15	2– 0 by 3– 0	1.25	$2.16	$2.68
20 by 16	3– 2	1.25	2.16	2.68
20 by 18	3– 6	1.29	2.36	2.92
20 by 20	3–10	1.32	2.68	3.44
20 by 22	4– 2	1.36		
20 by 24	4– 6	1.40	3.04	3.92
20 by 26	4–10	1.45	3.20	4.16
20 by 28	5– 2	1.48	3.36	4.44
20 by 30	5– 6	1.52		
22 by 20	2– 2 by 3–10	1.36		
22 by 24	4– 6	1.45		
22 by 26	4–10	1.48		
22 by 28	5– 2	1.52		
24 by 15	2– 4 by 3– 0	1.32	2.48	3.08
24 by 16	3– 2	1.32	2.48	3.08
24 by 18	3– 6	1.36		
24 by 20	3–10	1.40	3.04	3.92
24 by 22	4– 2	1.43		
24 by 24	4– 6	1.48	3.56	4.72
24 by 26	4 10	1.52	3.60	4.72
24 by 28	5- 2	1.56	3.92	5.20
24 by 30	5– 6	1.60		
26 by 15	2– 6 by 3– 0	1.36	2.76	3.56
26 by 18	3– 6	1.40		
26 by 20	3–10	1.45	3.20	4.16
26 by 22	4– 2	1.52		
26 by 24	4– 6	1.52	3.56	4.72
26 by 26	4–10	1.56	3.92	5.20

Two-light Check Rail 1⅜ In.—(*Continued*)

Glass Sizes	Opening Sizes	Open	S.S.	D.S.
26 by 28	5– 2	1.60	4.32	5.72
26 by 30	5– 6	1.64		
27 by 20	2– 7 by 3–10	1.56	3.92	5.20
27 by 22	4– 2	1.56		
27 by 24	4– 6	1.56	3.92	5.20
27 by 26	4–10	1.60	4.32	5.72
27 by 28	5– 2	1.63	4.68	6.28
27 by 30	5– 6	1.68		
28 by 18	2– 8 by 3– 6	1.45	3.20	4.16
28 by 20	3–10	1.48		
28 by 24	4– 6	1.56	3.92	5.20
28 by 26	4–10	1.60	4.28	5.72
28 by 28	5– 2	1.64	4.68	6.28
28 by 30	5– 6	1.68		
30 by 16	2–10 by 3– 2	1.45		
30 by 20	3–10	1.52	3.56	4.72
30 by 24	4– 6	1.60	4.20	5.60
30 by 26	4–10	1.64	4.68	6.28
30 by 28	5– 2	1.68	4.72	6.32
30 by 30	5– 6	1.72		
32 by 24	3– 0 by 4– 6	1.72	....	6.32
32 by 26	4–10	1.76	....	6.32
32 by 28	5– 2	1.80	....	7.40
34 by 16	3– 2 by 3– 2	1.60		
34 by 20	3–10	1.68		
34 by 26	4–10	1.80		
36 by 24	3– 4 by 4– 6	1.80		
36 by 26	4–10	1.84		
36 by 28	5– 2	1.88		
40 by 24	3– 8 by 4– 6	1.97		
40 by 26	4–10	2.02		
40 by 28	5– 2	2.05		
42 by 26	3–10 by 4–10	1.89		
52 by 26	4– 8 by 4–10	1.99		

Four-light Check Rail 1⅜ In.

Glass Sizes	Opening Sizes	Open 12 or More	Stock S.S.	Stock D.S.	Special Sizes 30 or More S.S.	30 or More D.S.	12 to 29 S.S.	12 to 29 D.S.	Less than 12 S.S.	Less than 12 D.S.
9 by 12	1–10 by 2– 6	$1.34	.....	.....	$1.84	.....	$1.92	.....	$2.28	
10 by 16	2– 0 by 3– 2	1.48	.....	.....	2.36	.....	2.48	.....	2.92	
10 by 18	3– 6	1.52	$2.52							
10 by 24	4– 6	1.68	.....	.....	3.04	.....	3.16	.....	3.76	
12 by 20	2– 4 by 3–10	1.65	3.00							
12 by 24	4– 6	1.76	3.52							
12 by 26	4–10	1.81	3.72							
12 by 28	5– 2	1.85	4.00							
12 by 30	5– 6	1.92	4.44							
14 by 24	2– 8 by 4– 6	1.83	.....	.....	3.96	.....	4.12	.....	4.92	
14 by 26	4–10	1.89	.....	.....	4.12	.....	4.28	.....	5.12	
14 by 28	5– 2	1.95	4.76							
14 by 30	5– 6	1.99	4.96							

Six-light Check Rail 1⅜ In.

Glass Sizes	Opening Sizes	Open 12 or More	Stock S.S.	Stock D.S.	Special Sizes 30 or More S.S.	30 or More D.S.	12 to 29 S.S.	12 to 29 D.S.	Less than 12 S.S.	Less than 12 D.S.
10 by 12	2–10 by 2– 6	$1.61	$2.44							
10 by 16	3– 2	1.72	3.12							
10 by 18	3– 6	1.75	3.32							

Eight-light Check Rail 1⅜ In.

Glass Sizes	Opening Sizes	Open 12 or More	Stock S.S.	Stock D.S.	Special Sizes 30 or More S.S.	30 or More D.S.	12 to 29 S.S.	12 to 29 D.S.	Less than 12 S.S.	Less than 12 D.S.
8 by 10	1– 8 by 3–10	$1.60	$2.36							
9 by 12	1–10 by 4– 6	1.75	2.84							
10 by 12	2– 0 by 4– 6	1.79	3.04							
10 by 14	5– 2	1.88	3.36							
10 by 15	5– 6	1.95	3.52							
12 by 14	2– 4 by 5– 2	1.97	3.96							

Eight-light Plain Rail 1⅛ In.

Glass Sizes	Opening Sizes	Open 12 or More	Stock S.S.	Stock D.S.	Special Sizes 30 or More S.S.	30 or More D.S.	12 to 20 S.S.	12 to 20 D.S.	Less than 12 S.S.	Less than 12 D.S.
8 by 10	1– 8 by 3–10	$1.39	$2.20							
9 by 12	1–10 by 4– 6	1.51	2.68							
10 by 12	2– 0 by 4– 6	1.55	2.88							
10 by 14	5– 2	1.63	3.20							

Twelve-light Check Rail 1⅜ In.

Glass Sizes	Opening Sizes	Open	S.S.	D.S.
8 by 10	2– 4 by 3–10	$1.88	$3.20	
9 by 12	2– 7 by 4– 6	2.07	3.88	
9 by 13	4–10	2.11	4.08	
9 by 14	5– 2	2.17	4.32	
10 by 12	2–10 by 4– 6	2.13	4.16	
10 by 14	5– 2	2.23		
10 by 15	5– 6	2.29		

Top Divided Six-light Check Rail 1⅜ In.

Glass Sizes	Opening Sizes	Open	S.S.	SS Top DS Bot.
20 by 15	2– 0 by 3– 0	$1.95	$3.04	
20 by 16	3– 2	1.95	3.04	
20 by 18	3– 6	1.99	3.24	
20 by 20	3–10	2.03	3.56	
20 by 24	4– 6	2.10	3.76	
20 by 26	4–10	2.15	3.92	
20 by 28	5– 2	2.18	4.24	
24 by 15	2– 4 by 3– 0	2.00	3.36	
24 by 16	3– 2	2.00	3.36	
24 by 20	3–10	2.07	3.92	
24 by 24	4– 6	2.16	4.44	
24 by 26	4–10	2.20	4.48	
24 by 28	5– 2	2.23	4.80	
26 by 15	2– 6 by 3– 0	2.06	3.64	
26 by 20	3–10	2.15	4.08	
26 by 24	4– 6	2.22	4.44	
26 by 26	4–10	2.26	4.80	
26 by 28	5– 2	2.30	5.20	
27 by 20	2– 7 by 3–10	2.26	4.80	
27 by 24	4– 6	2.26	4.80	
27 by 26	4–10	2.30	5.20	
27 by 28	5– 2	2.33	5.56	

Top Divided Six-light Check Rail 1⅜ In.—(*Continued*)

Glass Sizes	Opening Sizes	Open	S.S.	SS Top DS Bot.
28 by 18	2– 8 by 3– 6	2.15	4.08	
28 by 24	4– 6	2.23	4.80	
28 by 26	4–10	2.27	5.16	
28 by 28	5– 2	2.31	5.56	
30 by 20	2–10 by 3–10	2.22	4.44	
30 by 24	4– 6	2.27	5.08	
30 by 26	4–10	2.31	5.56	
30 by 28	5– 2	2.35	5.60	
32 by 24	3– 0 by 4– 6	2.42	....	$6.40
32 by 26	4–10	2.46	....	6.44
32 by 28	5– 2	2.50	....	7.32
34 by 16	3– 2 by 3– 2	2.49		
34 by 20	3–10	2.57		
34 by 26	4–10	2.69		
36 by 24	3– 4 by 4– 6	2.69		
36 by 26	4–10	2.73		
36 by 28	5– 2	2.77		
40 by 24	3– 8 by 4– 6	2.86		
40 by 26	4–10	2.90		
40 by 28	5– 2	2.94		

Top Divided Nine-light Check Rail 1⅜ In.

Glass Sizes	Opening Sizes	Open	S.S.	SS Top DS Bot.
24 by 16	2– 4 by 3– 2	$2.33		
24 by 20	3–10	2.41		
24 by 24	4– 6	2.49		
24 by 26	4–10	2.53		
24 by 28	5– 2	2.57		
28 by 24	2– 8 by 4– 6	2.57		
28 by 26	4–10	2.60		
28 by 28	5– 2	2.64		
30 by 24	2–10 by 4– 6	2.60		
30 by 26	4–10	2.64		
30 by 28	5– 2	2.69		
34 by 16	3– 2 by 3– 2	2.95		
34 by 20	3–10	3.03		
34 by 26	4–10	3.15		

Top Divided Four Vertical Light Check Rail 1⅜ In.

Glass Sizes	Opening Sizes	Open	S.S.	SS Top DS Bot.
24 by 16	2– 4 by 3– 2	$2.00		
24 by 20	3–10	2.07		
24 by 24	4– 6	2.16		
24 by 26	4–10	2.20		
24 by 28	5– 2	2.23		
28 by 24	2– 8 by 4– 6	2.23		
28 by 26	4–10	2.27		
28 by 28	5– 2	2.31		
30 by 24	2–10 by 4– 6	2.27		
30 by 26	4–10	2.31		
30 by 28	5– 2	2.35		
34 by 16	3– 2 by 3– 2	2.44		
34 by 20	3–10	2.52		
34 by 26	4–10	2.64		

Sash

Eight-light Casement Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅜ In.	Open 1¾ In.	Glazed 1⅜ In.	Glazed 1¾ In.
8 by 10	1– 8 by 3– 9¾	$1.27	$2.13	$2.64	$3.28
10 by 12	2– 0 by 4– 5¾	1.38	2.24	3.24	3.84
10 by 14	5– 1¾	1.49	2.69	3.68	4.52

Six-light Casement Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅜ In.	Open 1¾ In.	Glazed 1⅜ In.	Glazed 1¾ In.
8 by 10	1– 8 by 2–11½	$1.05	$1.72	$2.08	$2.52
10 by 12	2– 0 by 3– 5½	1.16	1.79	2.52	3.00
10 by 14	3–11½	1.23	1.87	2.84	3.28

Four-light Barn Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅛ In.	Glazed 1⅛ In.
8 by 10	1– 8 by 2– 1	$0.75	$1.20
9 by 12	1–10 by 2– 5	0.80	1.44
10 by 12	2– 0 by 2– 5	0.82	1.52

Six-light Barn Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅛ In.	Open 1⅜ In.	Glazed 1⅛ In.	Glazed 1⅜ In.
8 by 10	2– 4 by 2– 1	$0.90	$1.01	$1.64	$1.72
9 by 12	2– 7 by 2– 5	0.97	1.09	1.96	2.08
10 by 12	2–10 by 2– 5	1.00	1.14	2.12	2.24

Four-light Casement Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅜ In.	Open 1¾ In.	Glazed 1⅜ In.	Glazed 1¾ In.
8 by 10	1– 8 by 2– 1¼	$0.86	$1.34	$1.56	$1.92
9 by 12	1–10 by 2– 5¼	0.93	1.38	1.72	
10 by 12	2– 0 by 2– 5¼	1.01	1.42	1.92	2.20
10 by 14	2– 9¼	1.01	1.46	2.04	
10 by 16	3– 1¼	1.05	1.53	2.24	

One-light Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅜ In.	Glazed 1⅜ In.
16 by 20	1– 8 by 2– 1	$0.73	$1.36
16 by 24	2– 5	0.76	1.48
18 by 20	1–10 by 2– 1	0 76	1.44
18 by 24	2– 5	0.77	1.68
20 by 20	2– 0 by 2– 1	0.77	1.64
20 by 24	2– 5	0.80	1.80
24 by 20	2– 4 by 2– 1	0.79	1.80
24 by 24	2– 5	0.81	2.12
24 by 28	2– 9	0.85	2.32

Sash

Quarter Circle Sash S. S.

Opening Size	1⅜ In.
1 ft. 3 in. by 1 ft. 6 5/16 in.	$3.52

Two-light Cellar Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅜ In.	Glazed 1⅜ In.
8 by 10	1– 8 by 1– 3	$0.65	$0.88
10 by 12	2– 0 by 1– 5	0.72	1.04
10 by 14	1– 7	0.75	1.16
10 by 16	1– 9	0.77	1.28
12 by 8	2– 4 by 1– 1	0.75	0.96
12 by 15	1– 8	0.83	1.40
12 by 16	1– 9	0.83	1.40
12 by 20	2– 1	0.87	1.60
12 by 24	2– 5	0.92	1.88
14 by 14	2– 8 by 1– 7	0.86	1.36
14 by 16	1– 9	0.87	1.56
14 by 20	2– 1	0.92	1.76

Three-light Cellar Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅜ In.	Glazed 1⅜ In.
7 by 9	2– 1 by 1– 2	$0.64	$0.92
8 by 10	2– 4 by 1– 3	0.68	1.00
9 by 12	2– 7 by 1– 5	0.73	1.16
10 by 12	2–10 by 1– 5	0.76	1.28
10 by 14	1– 7	0.79	1.40
10 by 16	1– 9	0.80	1.60

Three-light Cellar Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅜ In.	Glazed 1⅜ In.
7 by 9	2– 1 by 1– 2	$0.72	
8 by 10	2– 4 by 1– 3	0.76	$1.08
9 by 12	2– 7 by 1– 5	0.83	1.24
10 by 12	2–10 by 1– 5	0.85	1.36
10 by 14	1– 7	0.89	
10 by 16	1– 9	0.91	

Nine-light Sash S. S.

Glass Sizes	Opening Sizes	Open 1⅜ In.	Glazed 1⅜ In.
8 by 10	2– 4 by 2–11	$1.29	$2.68
9 by 12	2– 7 by 3– 5	1.47	3.24
10 by 12	2–10 by 3– 5	1.52	3.56

Circle Top Sash S. S.

Opening Size	Glazed 1⅜ In.
2 ft. 6 in. by 1 ft. $6\frac{5}{16}$ in	$6.28

Sash

One-light Transom S. S.

Opening Sizes	Open 1⅜ In.	Glazed 1⅜ In.
2–6 by 1–0	$0.60	$1.04
2–6 by 1–2	0.62	1.16
2–6 by 1–4	0.63	1.24
2–8 by 1–0	0.62	1.12
2–8 by 1–2	0.63	1.16
2–8 by 1–4	0.65	1.36
2–8 by 1–6	0.67	1.56
3–0 by 1–2	0.71	1.40
3–0 by 1–4	0.73	1.52

Hot Bed Sash S. S.

3 Rows Glass

Opening Size	Open 1⅜ In.	Glazfd 1⅜ In.
3–0 by 6–0	$2.75	$6.64

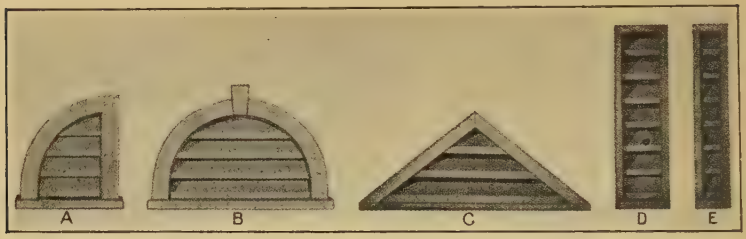


FIG. 19.—Louvres.

A

White Pine

1 ft. 3 in. by 1 ft. 6 5/16 in	$ 7.88
1 ft. 9 in. by 2 ft. 0 in	10.52

B

White Pine

2 ft. 6 in. by 1 ft. 6 5/16 in	$13.68
3 ft. 6 in. by 2 ft. 0 in	20.36

C

White Pine

Made for gables with any roof pitch and in any height desired	$10.24

D

White Pine

0 ft. 8 in. by 2 ft. 6 in	$5.16
0 ft. 8 in. by 3 ft. 6 in	6.60

E

White Pine

0 ft. 4 in. by 2 ft. 6 in	$4.48
0 ft. 4 in. by 3 ft. 6 in	5.36

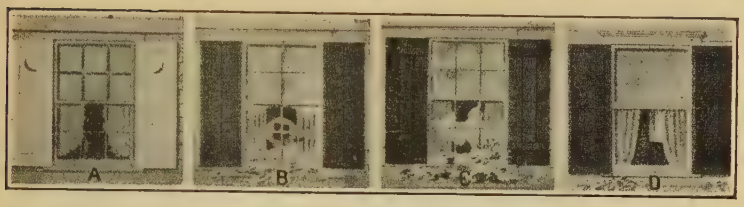


FIG. 20.—Shutters.

A
TWO-PANEL SHUTTER

B
ROLLING SLAT SHUTTER

SIZES	PRICES COVER LOTS OF FOUR OR LESS PAIRS	A PER PAIR	B PER PAIR
2 ft. 0 in. by 3 ft. 3 in.	1⅛ White Pine	$3.56	$8.36
2 ft. 10 in. by 3 ft. 3 in.	1⅛ White Pine	3.88	8.72
2 ft. 10 in. by 3 ft. 7 in.	1⅛ White Pine	4.04	8.80
2 ft. 10 in. by 4 ft. 7 in.	1⅛ White Pine	4.48	9.16
2 ft. 10 in. by 5 ft. 3 in.	1⅛ White Pine	4.72	9.64
2 ft. 10 in. by 5 ft. 7 in.	1⅛ White Pine	4.84	9.72
2 ft. 10 in. by 5 ft. 11 in.	1⅛ White Pine	5.04	9.84

For sizes wider than 2 ft. 10 in. add for each 2 in. or fraction thereof, per lineal foot, $0.06.

For lots of 5 to 9 pairs of a size and kind, deduct 10 per cent.

For lots of 10 or more pairs of a size and kind, deduct 21 per cent.

C
BATTEN SHUTTER

D
STATIONARY SLAT SHUTTER

SIZES	PRICES COVER LOTS OF FOUR OR LESS PAIRS	C PER PAIR	D PER PAIR
2 ft. 0 in. by 3 ft. 3 in.	1⅛ White Pine	$4.64	$7.96
2 ft. 10 in. by 3 ft. 3 in.	1⅛ White Pine	5.92	8.20
2 ft. 10 in. by 3 ft. 7 in.	1⅛ White Pine	6.68	8.52
2 ft. 10 in. by 4 ft. 7 in.	1⅛ White Pine	6.80	8.60
2 ft. 10 in. by 5 ft. 3 in.	1⅛ White Pine	7.36	8.92
2 ft. 10 in. by 5 ft. 7 in.	1⅛ White Pine	7.68	9.08
2 ft. 10 in. by 5 ft. 11 in.	1⅛ White Pine	7.92	9.20

For sizes wider than 2 ft. 10 in. add for each 2 in. fraction thereof, per lineal foot, $0.06.

For lots of 5 to 9 pairs of a size and kind, deduct 10 per cent.

For lots of 10 or more pairs of a size and kind, deduct 21 per cent.

Outside measurement is 4 in. and 7 in. greater than glass opening.

FIG. 21.—Door and window frames.

Made in White Pine Only. Pockets Cut and Pulleys Set
FOR 2 BY 4 STUD WALL (BEVELED SIDING)

2–10 by 5–10 Opening and Under

DESIGN	PRICE
C-1205 Window Frame 1⅛ in. O. S. C. Sub-sill Plain Cap	$5.48
C-1206 Window Frame 1⅛ in. O. S. C. Solid Sill Plain Cap	5.68
C-1207 Window Frame ⅞ in. O. S. C. Sub-sill Plain Cap	4.76
C-1208 Window Frame ⅞ in. O. S. C. Solid Sill Plain Cap	4.96

3–0 by 7–0 Opening and Under

C-1209 Door Frame 1⅛ in. O. S. C. Solid Sill Plain Cap	7.32
C-1210 Door Frame ⅞ in. O. S. C. Solid Sill Plain Cap	6.52
C-1211 Door Frame ⅞ in. O. S. C. Solid Sill Molded Cap	7.00
C-1212 Door Frame 1⅛ in. O. S. C. Solid Sill Molded Cap	7.80

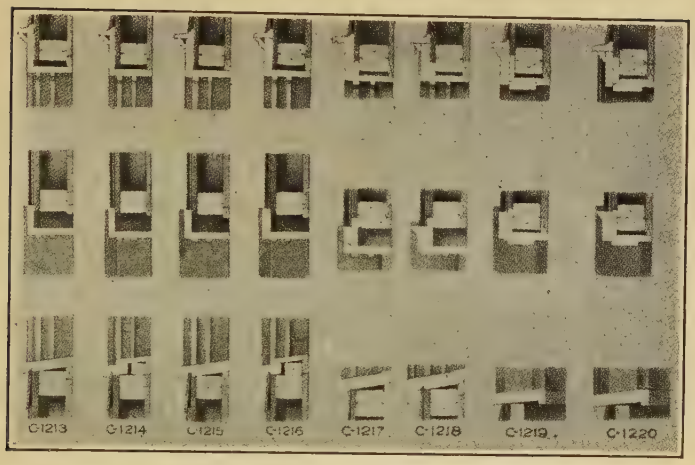


FIG. 22.—Door and window frames.

Made in White Pine Only. Pockets Cut and Pulleys Set
FOR 2 BY 4 STUD WALL (BEVELED SIDING)

2–10 by 5–10 Opening and Under

DESIGN	PRICE
C[a]1213 Window Frame 7/8 in. O. S. C. Solid Sill Molded Cap	$5.48
C-1214 Window Frame 7/8 in. O. S. C. Sub-sill Molded Cap	5.28
C-1215 Window Frame 1 1/8 in. O. S. C. Solid Sill Molded Cap	6.16
C-1216 Window Frame 1 1/8 in. O. S. C. Sub-sill Molded Cap	5.96
C-1217 Window Frame 1 1/8 in. O. S. C. Without Band Mold Rabbeted Sill	7.08
C-1218 Window Frame 1 1/8 in. O. S. C. With Band Mold Rabbeted Sill	7.32

3–0 by 7–0 Opening and Under

C-1219 Door Frame 1 1/8 in. O. S. C. Without Band Mold Oak Sill	10.44
C-1220 Door Frame 1 1/8 in. O. S. C. With Band Mold Oak Sill	10.80

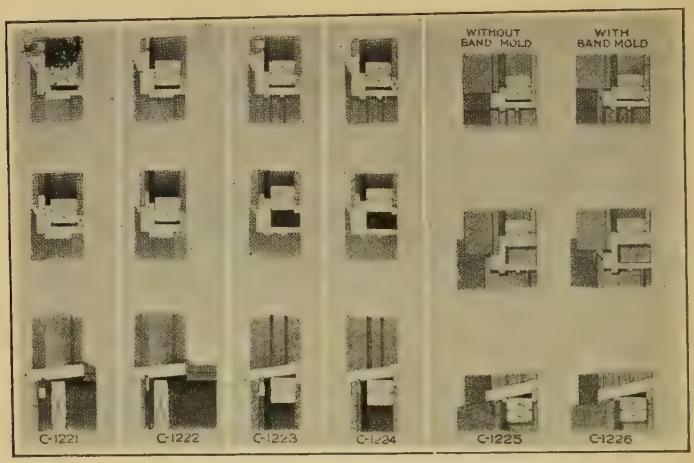


FIG. 23.—Door and window frames.

Made in White Pine Only. Pockets Cut and Pulleys Set

FOR STUCCO WALL

3–0 by 7–0 Opening and Under

DESIGN	PRICE
C-1221 Door Frame 1⅛ in. O. S. C. for ⅞ in. furring Oak Sill	$10.80
C-1222 Door Frame 1⅛ in. O. S. C. for lath furring Oak Sill	10.80

2–10 by 5–10 Opening and Under

C-1223 Window Frame 1⅛ in. O. S. C. for ⅞ in. furring Rabbeted Sill	7.32
C-1224 Window Frame 1⅛ in. O. S. C. for lath furring Rabbeted Sill	7.32

FOR BRICK VENEER WALL

2–10 by 5–10 Opening and Under

C-1225 Window Frame Without Band Mold Rabbeted Sill	6.48
C-1226 Window Frame With Band Mold Rabbeted Sill	6.76

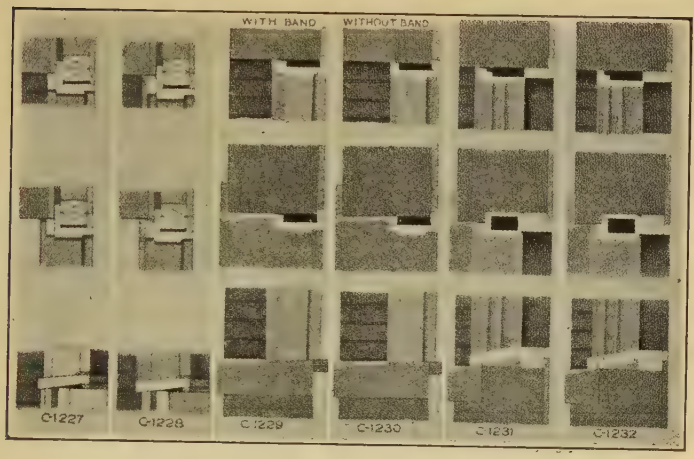


FIG. 24.—Door and window frames.

Made in White Pine Only. Pockets Cut and Pulleys Set.

FOR BRICK VENEER WALL

3–0 by 7–0 Opening and Under

DESIGN	PRICE
C-1227 Door Frame Without Band Mold Oak Sill	$ 9.88
C-1228 Door Frame With Band Oak Sill	10.24

FOR BRICK WALL

3–0 by 7–0 Opening and Under

C-1229 Door Frame With Band Mold No Sill	6.92
C-1230 Door Frame Without Band Mold No Sill	6.56

2–10 by 5–10 Opening and Under

C-1231 Window Frame With Band Mold Rabbeted Sill	7.28
C-1232 Window Frame Without Band Mold Rabbeted Sill	7.04

EXTRAS FOR ALL WINDOW AND DOOR FRAMES

Price of mullion frame is two times the price of a single frame, plus	$0.40
Price of triple frame is three times the price of a single frame, plus	1.00
Price of quad. frame is four times the price of a single frame, plus	1.60

WINDOW FRAMES

For each 2 in. in width or height over 2–10 by 5–10 opening, add	$0.08
For each 2 in. in width or height under 2–4 by 4–6 opening, deduct	0.06
For frame set up, add	1.0

DOOR FRAMES

For each extra 2 in. or fraction in width of height, add	$0.08
For frame set up, add	1.00
For sill omitted, deduct.....Pine, $0.72; Oak,	1.52
For hardware sill, add	0.80
For brick wall frames, add for each 2 in. or fraction over 5⅜ in. jambs	1.32

FIG. 25.—Casement sash frames.

For 2–0 by 4–6 Opening and Under

DESIGN	7/8 IN. CASING	1 1/8 IN. CASING
C-1233—C-1234 2 in. by 4 in. Frame Wall Plain Cap O. S. C.	$5.20	$ 5.68
C-1235—C-1236 2 in. by 4 in. Frame Wall Molded Cap O. S. C.	5.68	6.20
C-1237—C-1238 2 in. by 4 in. Frame Wall Molded Cap O. S. C.	.....	5.88
C-1239—C-1240 Stucco Wall Molded Cap O. S. C.	.....	6.12
For each extra 2 in. or fraction in width or height, add	0.10	0.10
For frame set up, add	1.00	1.00

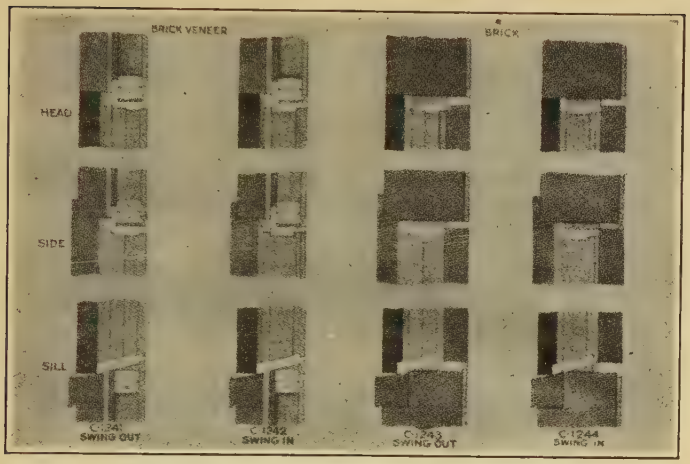


FIG. 26.—Casement sash frames.

For 2–0 by 4–6 Opening and Under

DESIGN	1⅛ IN. CASING
C-1241—C-1242 Brick Veneer Wall	$5.56
C-1243—C-1244 Brick Wall	5.20
The band mold shown on frames C-1241 and C-1242 can be applied to frames C-1243 and C-1244. If this is desired, it should be clearly stated in your order. Add for band mold	0.24
For each extra 2 in. or fraction in width or height, add	0.10
For frame set up, add	1.00

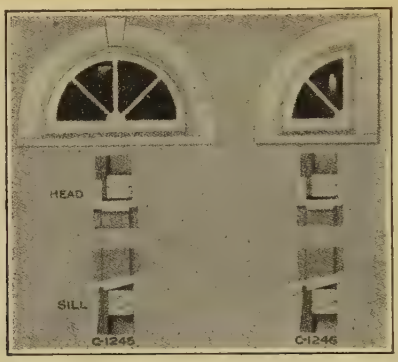


FIG. 27.—Gable and cellar frames, circle sash frames—set up.

	FOR 2 FT. 6 IN. BY 1 FT. $6\frac{5}{16}$ IN. OPG.		FOR 1 FT. 3 IN. BY 1 FT. $6\frac{5}{16}$ IN. OPG.	
	$\frac{7}{8}$ IN. CSG	$1\frac{1}{8}$ IN. CSG.	$\frac{7}{8}$ IN CSG.	$1\frac{1}{8}$ IN. CSG.
C-1245 Half Circle Frame O. S. C....	$8.16	$8.36		
C-1246 Quarter Circle Frame O. S. C..	.....	.....	$6.80	$7.00

Made for 2 in. by 4 in. stud wall circle inside. In ordering quarter circle sash frames, state whether in pairs and, if not, which side circle is on.

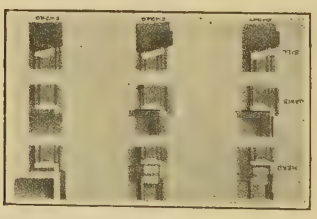


FIG. 28.—Gable and cellar frames, plank cellar sash frames—K. D.

DESIGN $5\frac{3}{8}$ IN. JAMBS	UP TO 2 FT. 10 IN. BY 1 FT. 11 IN.	UP TO 3 FT. 4 IN. BY 2 FT. 9 IN.
C-1247 Plain Cap (Frame Building).....	$3.28	$3.84
C-1248 Molded Cap (Stucco Building)...	3.40	4.00
C-1249 (Brick or Stone Building).....	3.12	3.68

If set up, add $0.68.

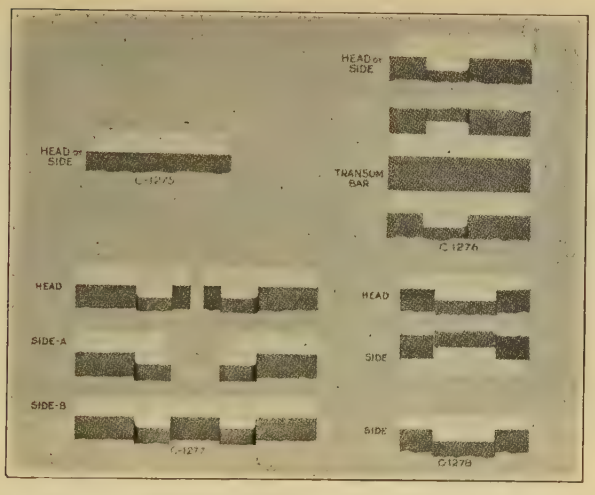


FIG. 29.—Inside door jambs.

FOR INSIDE DOORS AND CASED OPENINGS UP TO 3–0 BY 7–0, 5⅝-IN. WIDE OR LESS

DESIGN	WHITE WITH STOPS	PINE NO STOPS	YELLOW WITH STOPS	PINE NO STOPS	PLAIN WITH STOPS	OAK NO STOPS	UNSEL. WITH STOPS	BIRCH NO STOPS
C-1275.....	$2.96	$2.32	$2.76	$2.16	$5.08	$3.96	$5.08	$3.96
C-1276.....	5.00	3.92	4.64	3.64	8.56	6.64	8.56	6.64
C-1277.....	6.84	5.52	6.36	5.12	11.84	9.48	11.84	9.48
C-1278.....	.....	4.08	.....	3.80	.....	7.12	.....	.12

These jambs are furnished K. D. machined and dadoed at heads. Larger sizes, for each extra foot or part in width, add 10 per cent; each extra foot or part in height, add 20 per cent (over 3 ft. by 7 ft. price). For each extra 2 in. in width of jamb (thickness of wall), add 25 per cent to above price. For jambs made of two kinds of wood, apply highest listed price and add $1.44. Jambs are wrapped in paper, if requested, at a charge of 33 cts. per bundle.

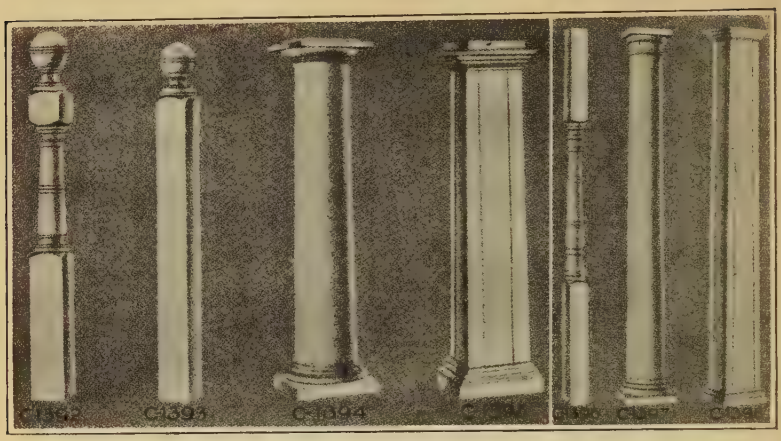


FIG. 30.—Porch newels and columns.

FIR NEWELS

SIZE	C-1392	C-1393	C-1394	C-1395
4 in. by 4 in. by 4 ft. 0 in	$0.88	$0.88		
5 in. by 5 in. by 4 ft. 0 in	1.40	1.40		
6 in. by 6 in. by 4 ft. 0 in	2.04	2.04	$2.72	
8 in. by 8 in. by 4 ft. 0 in	.....	.....	3.08	$3.08
10 in. by 10 in. by 4 ft. 0 in	.....	.....	3.76	3.76
12 in. by 12 in. by 4 ft. 0 in	.....	.....	.....	4.72

FIR COLUMNS—SOLID TURNED

C-1396

SIZE	8 FT. 0 IN.	9 FT. 0 IN.	10 FT. 0 IN.
4 in. by 4 in	$1.80	$2.04	$2.40
5 in. by 5 in	2.80	3.16	3.52
6 in. by 6 in	4.08	4.64	5.04

FIR STAVED COLONIAL COLUMNS

C-1397

SIZE	6 FT. 0 IN.	8 FT. 0 IN.	9 FT. 0 In.	10 FT. 0 IN.
6 in. by 6 in	$3.68	$3.92	$4.24	
8 in. by 8 in	4.64	4.92	5.60	$6.16
10 in. by 10 in	.....	6.44	7.28	8.28
12 in. by 12 in	.....	9.40	10.80	12.48

FIR SQUARE COLONIAL COLUMNS

C-1398

SIZE	6 FT. 0 IN.	8 FT. 0 IN.	9 FT. 0 IN.
8 in. by 8 in	$4.36	$5.20	$5.76
10 in. by 10 in	5.32	6.16	6.88
12 in. by 12 in	6.44	7.72	8.84

All above columns and newels in lots of 25 or more, 5 per cent less.

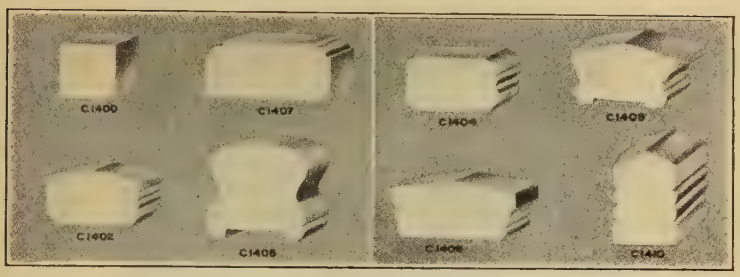


FIG. 31.—Porch material.

In Soft Wood Only

DESIGN	NAME	SIZE	PER CU. FT.
C-1400	Baluster Stock	1⅛ in. by 1⅛ in.	$1.92
		1⅜ in. by 1⅜ in.	3.12
		1¾ in. by 1¾ in.	4.80
	For baluster stock cut to length, figure 2 ft. long and add 10 per cent.		
C-1402	Top Rail	1⅝ in. by 2¾ in.	8.76
C-1404	Bottom Rail	1⅝ in. by 2¾ in.	8.76
C-1406	Top Rail	1⅝ in. by 3½ in.	11.00
C-1407	Bottom Rail	1⅝ in. by 3½ in.	11.00
C-1408	Top Rail	2¾ in. by 2¾ in.	15.96
C-1409	Top Rail	2¾ in. by 4⅝ in.	23.52
C-1410	Top Rail	1⅝ in. by 2¾ in.	8.76

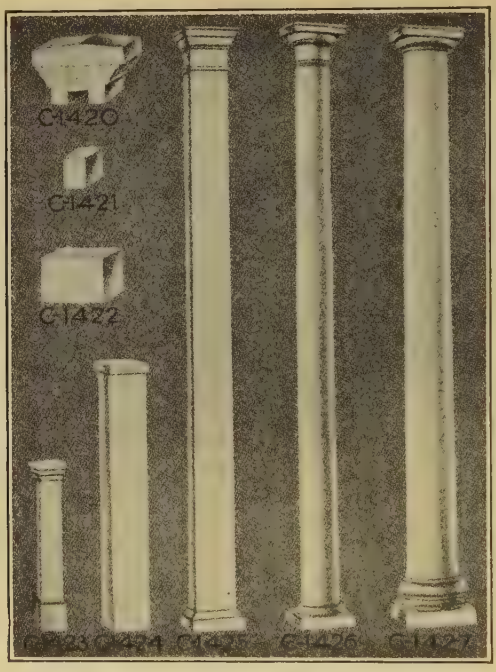


FIG. 32.—Porch material.

In Soft Wood Only

DESIGN	NAME	SIZE	PER CU. FT.
C-1420	Top Rail	3½ in. by 2¼ in. K. D	$22.36
C-1421	Lattice	¾ in. by 1⅛ in.	2.60
C-1422	Bottom Rail	1⅝ in. by 2⅝ in.	15.36
			EACH
C-1423	Newel	3 in. by 3 in. by 2 ft. 2 in.	$3.00
C-1424	Newel	5½ in. by 5½ in. by 3 ft. 6 in.	3.40
C-1425	Pilaster	2⅛ in. by 4½ in. by 7 ft. 5 in.	3.36
		2⅛ in. by 4½ in. by 7 ft. 9 in.	3.40
		2⅛ in. by 5 in. by 7 ft. 10 in.	3.52
		2⅛ in. by 5 in. by 8 ft. 8 in.; 8 ft. 9⅝ in.; 8 ft. 11 5/16 in.	3.88
		2⅛ in. by 5¾ in. by 7 ft. 10 in.	3.76
		2⅛ in. by 5¾ in. by 8 ft. 8 in.; 8 ft. 9⅝ in.; 8 ft. 11 5/16 in.	4.96
		2⅛ in. by 6½ in. by 7 ft. 9 in.	4.40
C-1426	Column	4⅞ in. to 4½ in. by 7 ft. 5 in.	3.80
		4⅞ in. to 4½ in. by 7 ft. 9 in.	3.88
		5¾ in. to 5 in. by 7 ft. 11 in.	4.24
		5¾ in. to 5 in. by 8 ft. 9 in.; 8 ft. 10⅝ in.; 9 ft. 5/16 in.	4.52
		6¾ in. to 5¾ in. by 7 ft. 11 in.	5.04
		6¾ in. to 5¾ in. by 8 ft. 9 in.; 8 ft. 10⅝ in.; 9 ft. 5/16 in.	5.68
C-1427	Column	7¾ in. to 6½ in. by 7 ft. 10 in.	5.68

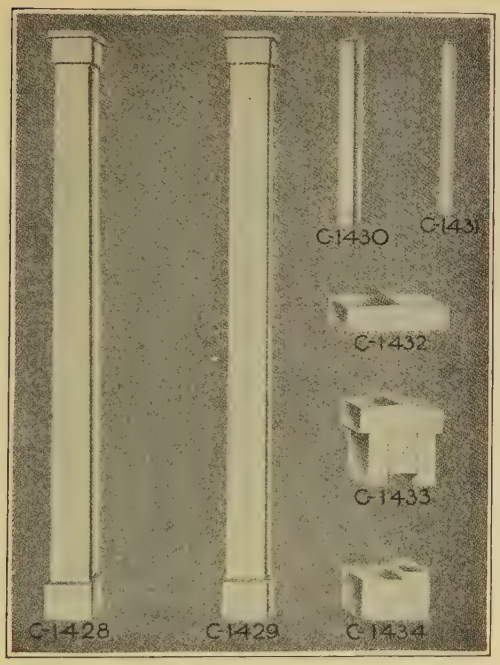


FIG. 33.—Porch material.

In Soft Wood Only

DESIGN	NAME	SIZE	EACH
C-1428	Post (built up)	5½ in. by 5½ in. by 7 ft. 10 in.	$7.12
C-1429	Pilaster (built up)	2¾ in. by 5½ in. by 7 ft. 10 in.	5.60
			PER 100
C-1430	Baluster	2½ in. by 2½ in. by 2 ft. 6 in.	$54.76
C-1431	Baluster	1⅛ in. by 1⅛ in. by 2 ft. 2¾ in.	7.24
			PER Cu. FT.
C-1432	Top Rail	1⅛ in. by 4 in.	$18.00
C-1433	Top Rail (built up)	3¼ in. by 3⅛ in. K. D.	24.48
C-1434	Bottom Rail	2 in. by 2¾ in.	19.24

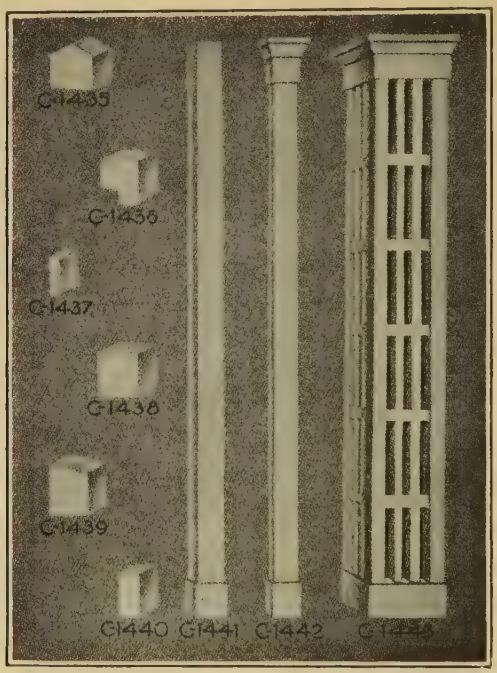


FIG. 34.—Porch material.

In Soft Wood Only

DESIGN	NAME	SIZE	PER Cu. FT.
C-1435	Top Rail	1¾ in. by 1¾ in.	$10.36
C-1436	Top Rail	1½ in. by 1¾ in.	8.32
C-1437	Lattice	⅜ in. by 1½ in.	2.88
C-1438	Baluster Stock	1¾ in. by 1¾ in.	10.08
C-1439	Bottom Rail	1½ in. by 2 in.	9.20
C-1440	Lattice	¾ in. by 1¾ in.	4.08
			EACH
C-1441	Post (built up)	3½ in. by 3½ in. by 7 ft. 10 in.	$3.56
C-1442	Pilaster (built up)	3½ in. by 1⅝ in. by 7 ft. 10 in.	3.24
C-1443	Post (built up)	11 in. by 11 in. by 7 ft. 10 in.	22.92

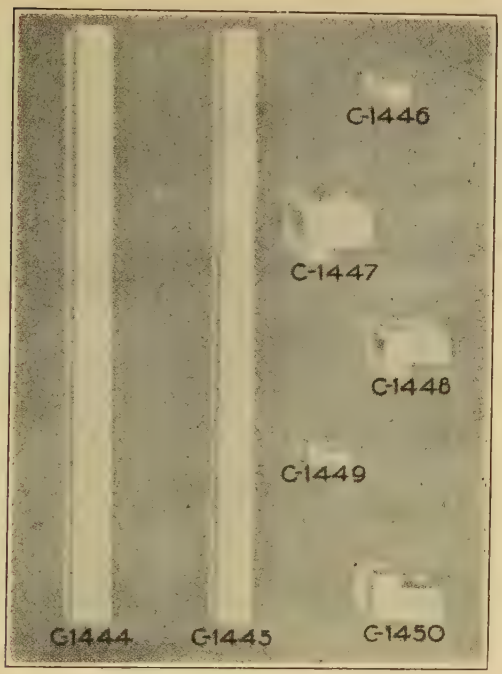


FIG. 35.—Porch material.

In Soft Wood Only

DESIGN	NAME	SIZE	EACH
C-1444	Post (built up)	4 in. by 4 in. by 7 ft. 10 in.	$3.28
		5½ in. by 5½ in. by 7 ft. 10 in.	4.48
C-1445	Pilaster (built up)	1¾ in. by 3½ in. by 7 ft. 10 in.	1.56
		2 in. by 3½ in. by 7 ft. 10 in.	1.68
		2¾ in. by 5½ in. by 7 ft. 10 in.	2.40

			PER CU. FT.
C-1446	Stop	¾ in. by ¾ in.	$ 2.04
C-1447	Top Rail	2½ in. by 2⅝ in.	21.48
C-1448	Top Rail	1¾ in. by 2¾ in.	24.94
C-1449	Bottom Rail	¾ in. by 1½ in.	5.48
C-1450	Bottom Rail	1¾ in. by 2⅝ in.	14.84

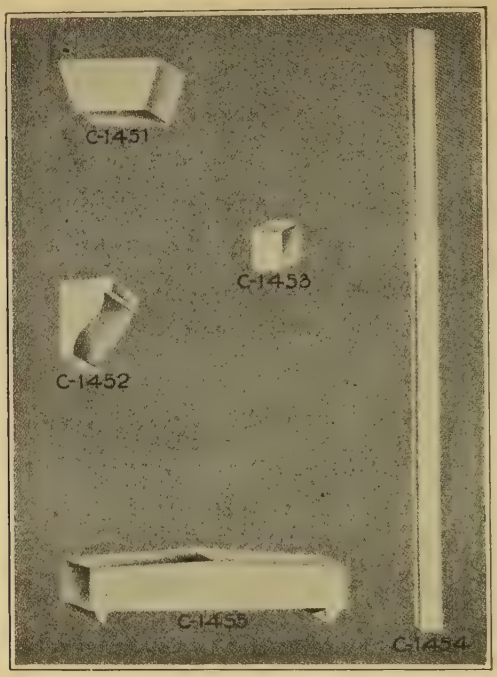


FIG. 36.—Porch material.

In Soft Wood Only

DESIGN	NAME		SIZE	EACH
C-1451	Key Block	2	in. by 2 in. by 4 in.	$0.16
C-1452	Bracket	2	in. by 2 in. by 3 in.	0.12
				PER CU. FT.
C-1453	Lattice	1	in. by 1½ in.	$5.88
				EACH
C-1454	Post	2	in. by 2 in. by 7 ft. 10 in.	$1.32
		3	in. by 3 in. by 7 ft. 10 in.	2.08
		3½	in. by 3½ in. by 7 ft. 10 in.	2.20
				PER CU. FT
C-1455	Top Rail	1¾	in. by 10¼ in. K. D.	$58.32

½ in. quarter round at sides.

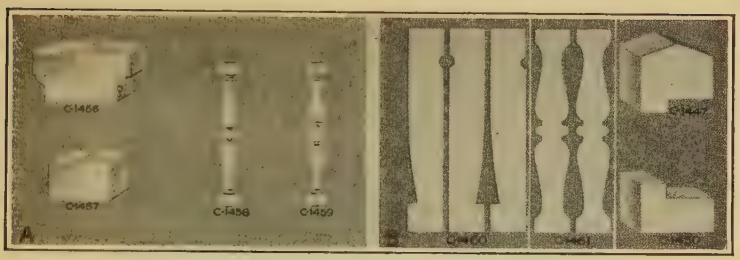


FIG. 37.—Porch material.

In Soft Wood Only

DESIGN	NAME	A	SIZE	PER CU. FT.
C-1456	Top Rail		2¼ in. by 4¼ in. K. D.	$33.36
C-1457	Top Rail		1¾ in. by 3 in.	16.72
		A		PER 100
C-1458	Baluster		2⅝ in. by 2⅝ in. by 2 ft. 0½ in.	$91.88
C-1459	Baluster		2⅝ in. by 2⅝ in. by 2 ft. 0½ in.	91.88
DESIGN	NAME	B	SIZE	PER CU. FT.
C-1447	Top Rail		2½ in. by 2⅝ in.	$21.48
C-1450	Bottom Rail		1¾ in. by 2⅝ in.	14.84
		B		PER 100
C-1460	Baluster		1⅛ in. by 5 in. by 2 ft. 6 in.	$65.24
C-1461	Baluster		1⅛ in. by 5 in. by 2 ft. 6 in.	67.88

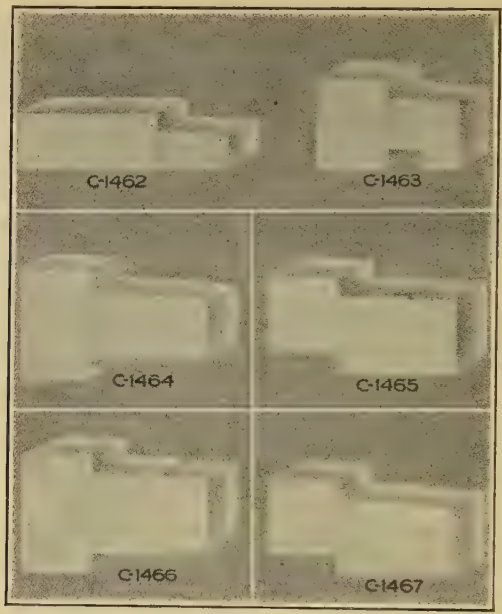


FIG. 38.—Screen porch enclosure.

In Soft Wood Only

DESIGN	NAME	SIZE	PER CU. FT.
C-1462	Jamb	$1\frac{3}{8}$ in. by $5\frac{1}{4}$ in.	$14.92
C-1463	Sash Sill	$2\frac{1}{4}$ in. by $3\frac{1}{2}$ in.	23.24
C-1464	Transom Bar	$2\frac{3}{4}$ in. by $4\frac{5}{8}$ in.	41.04
C-1465	Sash Mullion	2 in. by $4\frac{5}{8}$ in.	32.56
C-1466	Transom Mullion	$2\frac{5}{8}$ in. by $4\frac{5}{8}$ in.	41.04
C-1467	Transom Bar	$2\frac{3}{8}$ in. by $4\frac{5}{8}$ in.	40.80

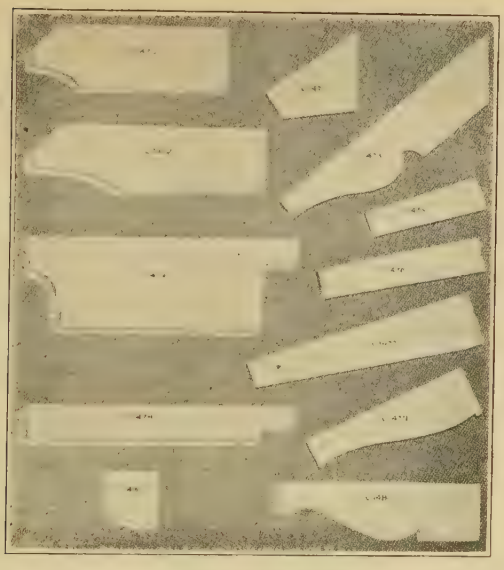


FIG. 39.—Rafter ends.

In Soft Wood Only

DESIGN	NAME	WIDTH	LENGTH	THICKNESS	PROJECTION	EACH
C-1470	Gable Termination	5½ in.	1 ft. 8 in.	5 in.	0 ft. 5½ in.	$1.76
		7½ in.	1 ft. 8 in.	5 in.	0 ft. 5½ in.	2.52
C-1471	Rafter End	6¾ in.	1 ft. 8 in.	1⅝ in.	0 ft. 9½ in.	1.00
C-1472	Gable Termination	5½ in.	2 ft. 0 in.	5 in.	0 ft. 9½ in.	2.12
		7½ in.	2 ft. 0 in.	5 in.	0 ft. 9½ in.	2.76
C-1473	Rafter End	5⅝ in.	3 ft. 6 in.	2¼ in.	1 ft. 9 in.	2.16
C-1474	Gable Bracket	9⅝ in.	2 ft. 5 in.	3⅝ in.	2 ft. 0 in.	3.56
C-1475	Rafter End	3⅝ in.	2 ft. 6 in.	1⅝ in.	1 ft. 1½ in.	0.60
C-1476	Rafter End	3⅝ in.	3 ft. 0 in.	1⅝ in.	1 ft. 6 in.	0.60
C-1477	Rafter End	5⅝ in.	3 ft. 6 in.	1⅝ in.	2 ft. 1½ in.	1.12
C-1478	Gable Bracket	3⅝ in.	2 ft. 5 in.	3⅝ in.	2 ft. 0 in.	1.48
C-1479	Rafter End	5¼ in.	3 ft. 6 in.	2¼ in	1 ft. 7 in.	2.12
C-1480	Bracket for Overhang	5½ in.	0 ft. 6¼ in.	3⅝ in.	0 ft. 5½ in.	1.04
C-1481	Rafter End	5⅝ in.	3 ft. 0 in.	2¼ in.	1 ft. 9 in.	1.60

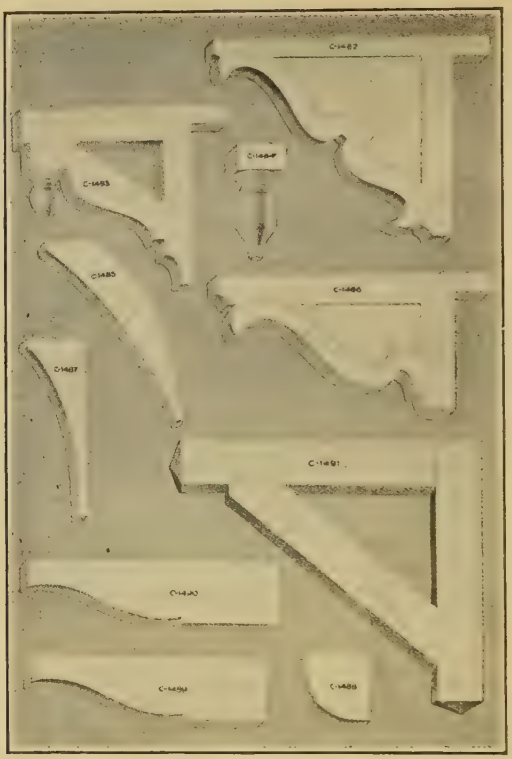


FIG. 40.—Brackets.

DESIGN	NAME	DROP	PROJECTION	THICKNESS	EACH
		In Soft Wood Only			
C-1482	Hood Bracket	1 ft. 10 in.	2 ft. 1¾ in.	3 in.	$5.88
C-1483	Bay or Hood Bracket	1 ft. 8 in.	1 ft. 6 in.	3⅝ in.	4.68
C-1484	Drop for Overhang[1]	0 ft. 11¾ in.			2.56
C-1485	Porch Bracket	1 ft. 9 in.	0 ft. 10¾ in.	5½ in.	3.56
C-1486	Hood Bracket	1 ft. 3⅛ in.	2 ft. 1 in.	3 in.	4.04
C-1487	Porch Bracket	0 ft. 5½ in.	1 ft. 6 in.	3¾ in.	1.52
		0 ft. 7 in.	1 ft. 8 in.	3⅝ in.	1.80
C-1488	Porch Bracket	0 ft. 5½ in.	0 ft. 7½ in.	3¾ in.	1.04
		0 ft. 5½ in.	0 ft. 7½ in.	5½ in.	1.48
C-1489	Bay Bracket	0 ft. 7 in.	1 ft. 7½ in.	3⅝ in.	2.12
C-1490	Bay Bracket	0 ft. 7 in.	1 ft. 10½ in.	3⅝ in.	2.12
C-1491	Hood Bracket	3 ft. 2 in.	3 ft. 2 in.	Main Members, 5¼ in. Braces, 4½ in.	6.72

[1] Square portion of C-1484 is 5¼ in. by 5¼ in. Maximum diameter of turned portion is 4½ in.

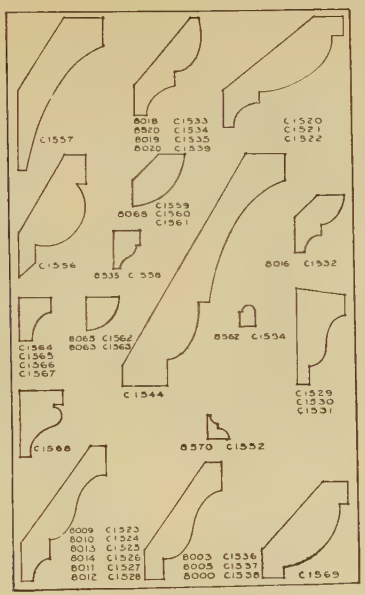


FIG. 41.—Exterior moldings.

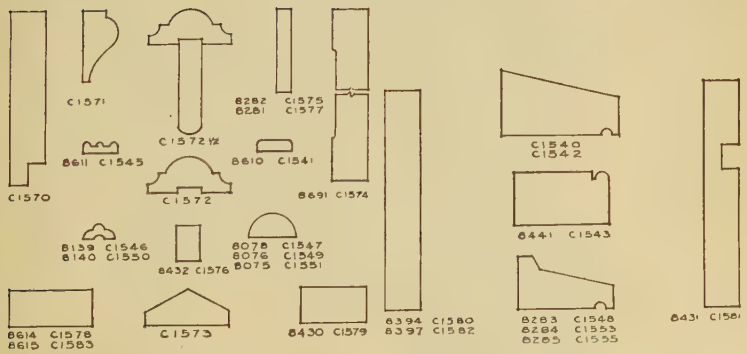


FIG. 42.—Exterior moldings.

The 8000 series are Standard Molding List numbers. The C-1500 series are Curtis numbers.

Exterior Moldings

Prices per 100 lin. ft.

Curtis Number	Universal Number	Name	Size	White Pine
C-1520	....	Crown mold	¾ by 3	$ 5.84
C-1521	....	Crown mold	1⅛ by 4⅜	14.84
C-1522	....	Crown mold	1⅛ by 3¾	11.88
C-1523	8009	Crown mold	¾ by 3⅝	7.20
C-1524	8010	Crown mold	¾ by 2¾	5.00
C-1525	8013	Crown mold	¾ by 4⅝	9.92
C-1526	8014	Crown mold	¾ by 3¼	6.32
C-1527	8011	Crown mold	¾ by 2¼	4.16
C-1528	8012	Crown mold	¾ by 4¼	8.56
C-1529	....	Bed mold	¾ by 1¾	3.32
C-1530	....	Bed mold	¾ by 2¼	7.48
C-1531	....	Frieze mold	1⅜ by 2¼	9.00
C-1532	8016	Bed mold	¾ by 1¾	3.32
C-1533	8018	Bed mold	¾ by 2¼	4.16
C-1534	8520	Bed mold	¾ by 2	3.76
C-1535	8019	Bed mold	¾ by 2¾	5.00
C-1536	8003	Crown mold	¾ by 2¾	5.00
C-1537	8005	Crown mold	¾ by 4⅝	9.92
C-1538	8000	Crown mold	¾ by 3¼	6.32
C-1539	8020	Bed or crown mold	¾ by 3¼	6.32
C-1540	....	Water table	1⅜ by 2½	9.92
C-1541	8610	Screen mold	¼ by ¾	1.32
C-1542	....	Water table	1⅜ by 1⅝	7.20
C-1543	8441	Brick mold	1⅛ by 2	6.76
C-1544	....	Cornice mold	1⅝ by 6½	20.80
C-1545	8611	Screen mold	¼ by ¾	1.32
C-1546	8139	Screen mold	5/16 by ⅝	1.32
C-1547	8078	Half round	½ by 1	2.08
C-1548	8283	Drip cap	1⅛ by 1⅝	5.96
C-1549	8076	Half round	5/16 by ⅝	1.68
C-1550	8140	Screen mold	⅜ by ¾	1.32
C-1551	8075	Half round	½ by 7/16	1.68
C-1552	8570	Stop	½ by 9/16	1.68
C-1553	8284	Drip cap	1⅛ by 2	6.76
C-1554	8562	Glass stop	⅜ by ½	1.68
C-1555	8285	Drip cap	1⅛ by 2½	8.20
C-1556	....	Cornice mold	1⅛ by 3¼	10.44
C-1557	....	Sprung cove mold	1⅛ by 4	13.40
C-1558	8535	Apron mold	⅝ by ⅞	1.68
C-1559	....	Quarter round	⅝ by 1½	2.92
C-1560	8068	Quarter round	¾ by 1¾	3.32
C-1561	....	Quarter round	¾ by 2¼	4.16
C-1562	8065	Quarter round	¾ by ¾	1.68
C-1563	8063	Quarter round	½ by ½	1.68
C-1564	....	Cove mold	¾ by 1⅜	2.92
C-1565	....	Cove mold	¾ by 1¾	3.32
C-1566	....	Cove mold	¾ by 1	2.08
C-1567	....	Cove mold	⅝ by ¾	1.68
C-1568	....	Cornice mold	1 by 1½	4.84
C-1569	....	Cornice mold	1 by 3	9.72
C-1570	....	Jamb lining	¾ by 3⅝	7.20
C-1571	....	Brick mold	¾ by 1½	2.92
C-1572	....	Batten	¾ by 1¾	3.32
C-1572½	....	Astragal	1¾ by 2½	13.68
C-1573	....	Batten	¾ by 1¾	3.32
C-1574	8691	Base	¾ by 7¼	17.04
C-1575	8282	Lattice strip	5/16 by 1¾	2.32
C-1576	8432	Parting stop	½ by ¾	1.68
C-1577	8281	Lattice strip	5/16 by 1⅜	1.68
C-1578	8614	Screen stock	¾ by 1¾	3.32
C-1579	8430	Blind stop	¾ by 1⅜	2.52
C-1580	8394	Head casing	¾ by 4⅝	11.72
C-1581	8431	Pulley stile	¾ by 4¾	11.72
C-1582	8397	Head casing	¾ by 5	12.80
C-1583	8615	Screen stock	¾ by 2¾	5.00

Above prices for 500 lin. ft. of a size and kind. For less than 500 lin. ft., add 10 per cent. For specific lengths or for cut lengths, add 10 per cent. For sanding molding, add 5 per cent. Exterior moldings are wrapped only when so ordered, at a charge of 33 cts. per bundle.

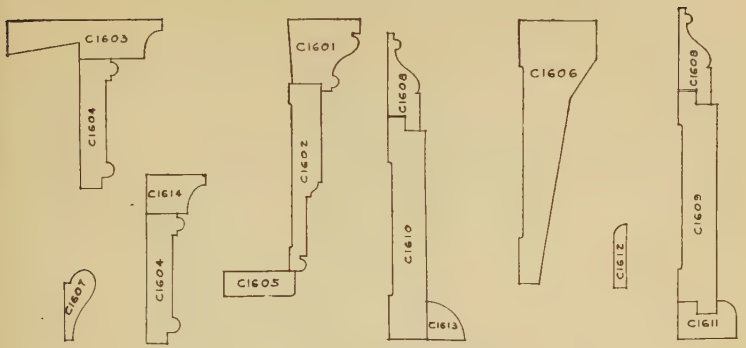


Fig. 43.—Interior trim C-1600.

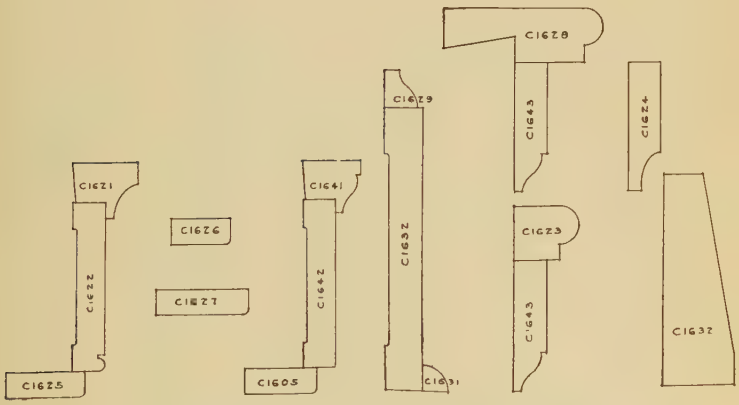


Fig. 44.—Interior trim C-1620 and C-1640.

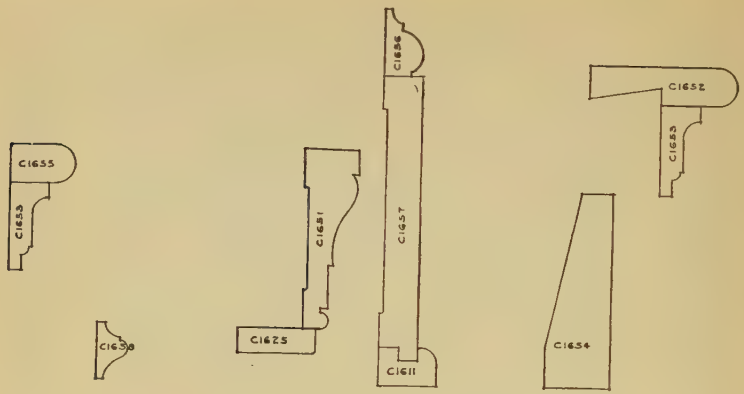


Fig. 45.—Interior trim C-1650.

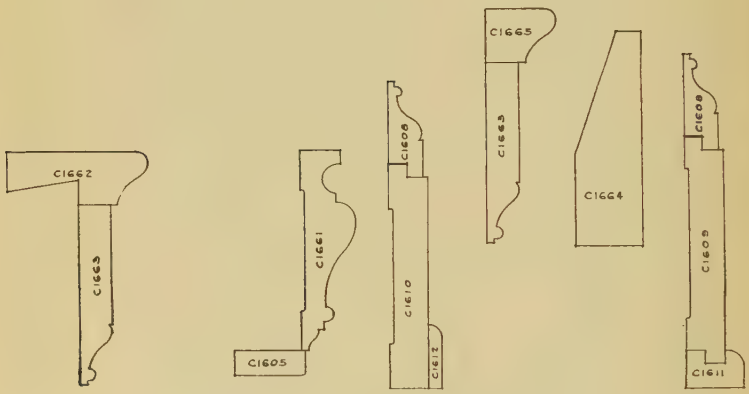


Fig. 46.—Interior trim C-1660.

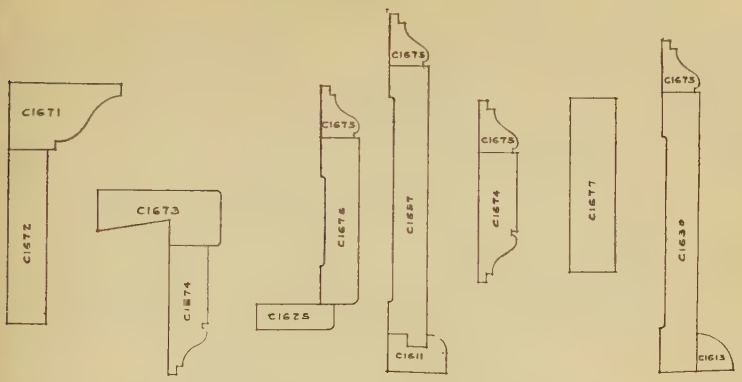


FIG. 47.—Interior trim C-1670.

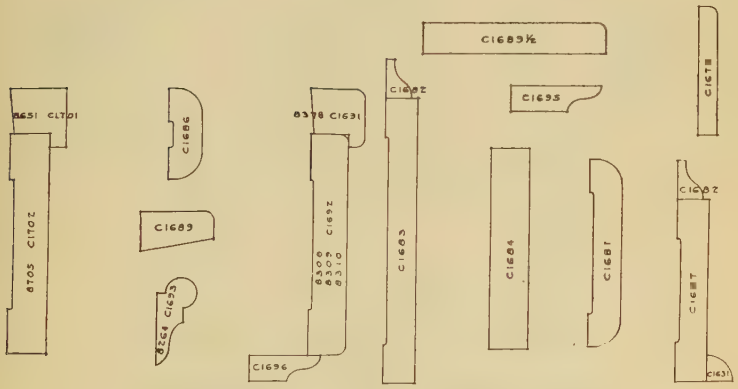


FIG. 48.—Interior trim C-1680 and C-1685.

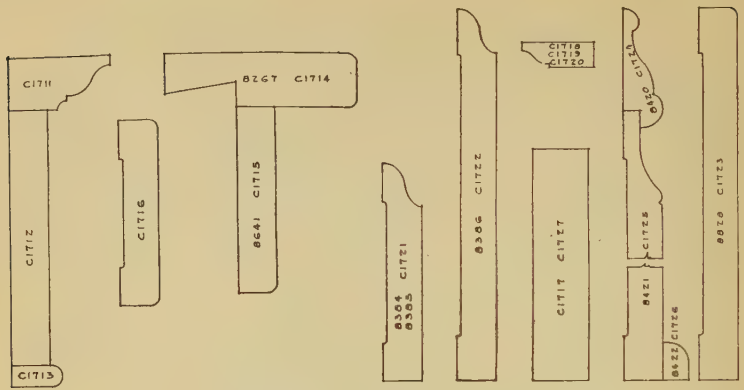


FIG. 49.—Interior trim C-1690, C-1700 and C-1710.

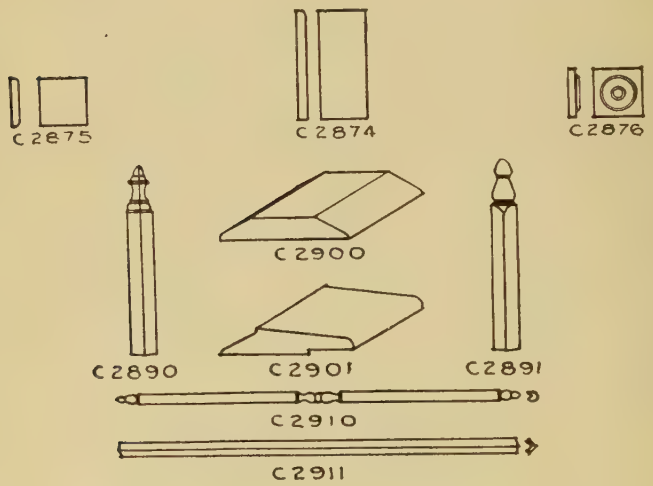


FIG. 50.—Miscellaneous interior trim.

BLOCKS

DESIGN	SIZE	PER 100 WHITE PINE	PER 100 YELLOW PINE
C-2874	1⅛ in. up to 5¼ in. by 10 in.	$14.40	$12.72
C-2874	1⅜ in. up to 5¼ in. by 10 in.	16.00	14.12
C-2875	1⅛ in.—4½ in. by 4½ in.	11.20	9.88
C-2876	1⅛ in.—4½ in. by 4½ in.	8.00	7.16

BASE ANGLES

Design	Size	Per 100 White Pine	Per 100 Yellow Pine
C-2890 and C-2891	1¾ in. by 14 in.	$8.36	$8.36

THRESHOLDS

		Oak, Each
C-2900	3¾ in. by 3 ft. 0 in. and under	$ 0.24
C-2901	3¾ in. by 3 ft. 0 in. and under	.26
Long lengths either design	Per C′	11.00

CORNER BEADS

Design	Size	Per 100 White Pine	Per 100 Yellow Pine
C-2910—C-2911	1⅜ in. by 4 ft.	$21.00	$21.00
C-2910—C-2911	1¾ in. by 4 ft.	27.72	27.72

INTERIOR TRIM MOLDINGS

Prices per 100 Lineal Feet

Design	Sizes	White Pine	Yellow Pine	Plain Oak	Unsel. Birch
C-1601 Back Band	⅝ by 1⅜	$ 6.76	.....	.....	$10.52
C-1602 Casing	⅝ by 3⅝	7.56	.....	.....	11.76
C-1603 Stool	13/16 by 2⅞	9.72	.....	.....	18.36
C-1604 Apron or Chair Rail	¾ by 2½	4.60	.....	.....	7.72
C-1605 Window Stop	½ by 1⅜	2.52	$2.32	$4.20	4.20
C-1606 Plinth Block, per 100, 1½ in. thick.		29.72			56.12
C-1607 Picture Mold	⅝ by 1⅜	2.92	2.68	4.92	4.92
C-1608 Base Mold	⅝ by 1⅞	4.16	4.16	7.00	7.00
C-1609 Base	¾ by 4⅜	9.44	8.76	17.84	17.84
C-1610 Base	¾ by 4⅜	9.44	8.76	17.84	17.84
C-1611 Shoe	¾ by 1⅜	2.08	1.92	3.52	3.52
C-1612 Shoe	¼ by 1¼	1.84	1.68	3.08	3.08
C-1613 Shoe	¾ by ¾	1.68	1.52	2.80	2.80
C-1614 Chair Rail Cap	13/16 by 1⅛	3.52	.....	.....	5.88
C-1621 Back Band	1⅛ by 1¼	4.60	.....	7.72	7.72
C-1622 Casing	⅝ by 3¼	6.32	.....	9.80	9.80
C-1623 Chair Rail Cap	1⅛ by 1¼	4.16	.....	7.00	7.00

Interior Trim Moldings
Prices per 100 lin. ft.

Design		Sizes	White Pine	Yellow Pine	Plain Oak	Unselected Birch
C-1624	Apron or chair rail	5/8 by 2 1/2	$ 4.60	.....	$ 7.72	$ 7.72
C-1625	Window stop	1/2 by 1 1/2	2.92	$ 2.68	4.92	4.92
C-1626	Window stop	1/2 by 1 3/8	2.08	1.92	3.52	3.52
C-1627	Door stop	1/2 by 1 3/4	3.32	3.08	5.60	5.60
C-1628	Stool	1 1/8 by 3	9.72	.....	18.36	18.36
C-1629	Base mold	5/8 by 3/4	1.68	.....	2.80	2.80
C-1630	Base	3/4 by 5 1/2	11.72	10.84	22.12	22.12
C-1631	Shoe	1/2 by 1/2	1.68	1.52	2.80	2.80
C-1632	Plinth block, per 100, 1 3/8 in. thick	.....	17.12	.....	32.32	32.32
C-1641	Back band	1 by 1 3/8	3.92	.....	6.60	6.60
C-1642	Casing	5/8 by 3 1/4	6.32	.....	9.80	9.80
C-1643	Apron or chair rail	5/8 by 2 1/2	4.60	.....	7.72	7.72
C-1651	Casing	1 1/8 by 3 1/2	.....	10.32	21.08	
C-1652	Stool	13/16 by 2 3/4	.....	8.32	17.00	
C-1653	Apron or chair rail	3/4 by 1 3/4	.....	3.08	5.60	
C-1654	Plinth block, per 100, 1 1/4 in. thick	.....	.....	13.32	27.20	
C-1655	Chair rail cap	13/16 by 1 1/4	.....	4.16	7.00	
C-1656	Base mold	3/4 by 15/16	.....	2.68	4.92	
C-1657	Base	3/4 by 5 1/2	.....	10.84	22.12	
C-1658	Plaster mold	5/8 by 1 1/8	2.08	1.92	3.52	3.52
C-1661	Casing	1 1/8 by 3 1/8	.....	12.40	25.32	25.32
C-1662	Stool	1 1/8 by 2 5/8	.....	8.32	17.00	17.00
C-1663	Apron or chair rail	5/8 by 3 1/2	.....	7.00	11.76	11.76
C-1664	Plinth block, per 100, 1 1/4 in. thick	.....	.....	15.84	32.32	32.32
C-1665	Chair rail cap	1 1/8 by 1 3/8	.....	4.84	8.12	8.12
C-1671	Cap mold	1 3/8 by 2 1/8	.....	8.32		
C-1672	Head casing	3/4 by 3 3/8	.....	7.00		
C-1673	Stool	1 1/8 by 2 1/4	.....	6.92		
C-1674	Apron or chair rail	3/4 by 2 1/2	.....	4.60		
C-1675	Scribing mold	3/4 by 1	.....	1.92		
C-1676	Side casing	3/4 by 3 1/4	.....	5.84		
C-1677	Plinth block, per 100, 7/8 in. thick	.....	.....	10.32		
C-1679	Stop	3/8 by 2 1/2	.....	4.60	7.72	
C-1681	Casing	5/8 by 3 5/8	.....	7.00	11.76	
C-1682	Base mold	1/2 by 3/4	.....	1.52	2.80	
C-1683	Base	5/8 by 5 1/2	.....	10.84	22.12	
C-1684	Plinth block, per 100, 3/4 in. thick	.....	.....	7.52	15.32	
C-1686	Casing	5/8 by 1 3/4	.....	3.08	5.60	
C-1687	Base	5/8 by 3 1/2	.....	7.00	11.76	
C-1688	Plinth block, per 100, 3/4 in. thick	.....	.....	3.76	6.32	
C-1689	Stool	3/4 by 1 3/8	.....	2.68	4.92	
C-1689 1/2	Stool	5/8 by 3 1/2	.....	6.24	10.52	
C-1691	Back band	1 1/8 by 1 1/8	.....	3.92	6.60	6.60
C-1692	Casing	3/4 by 4 1/4	.....	8.32	17.00	17.00

Prices per 100 lin. ft.—(*Continued*)

Design		Sizes	White Pine	Yellow Pine	Pain Oak	Unselected Birch
C-1693	Picture mold	¾ by 1¾	.....	3.08	5.60	5.60
C-1694	Window stop	½ by 1¾	.....	1.92	3.52	3.52
C-1695	Door stop	½ by 1¾	.....	3.08	5.60	5.60
C-1696	Window stop	½ by 1⅜	.....	2.32	4.20	4.20
C-1701	Back band	1⅛ by 1⅛	.....	3.92	6.60	6.60
C-1702	Casing	¾ by 4¼	.....	8.32	17.00	17.00
C-1711	Cap mold	1⅛ by 2	....	6.24	10.52	10.52
C-1712	Head casing	¾ by 5	.....	10.00	20.40	20.40
C-1713	Fillet	7/16 by 1	.....	1.68	3.08	3.08
C-1714	Stool	1⅛ by 3½	.....	11.00	22.44	22.44
C-1715	Apron	¾ by 3½	.....	7.00	11.76	11.76
C-1716	Side casing	¾ by 3½	.....	7.00	11.76	11.76
C-1717	Plinth block, per 100, 1⅛ in. thick	.....	.....	11.00	22.44	22.44
C-1718	Window stop	½ by 1⅜	.....	2.32	4.20	4.20
C-1719	Window stop	½ by 1⅜	.....	1.92	3.52	3.52
C-1720	Door stop	½ by 1¾	.....	3.08	5.60	5.60
C-1721	Side casing	¾ by 4¼	.....	8.32	17.00	17.00
C-1722	Base	¾ by 7¼	.....	13.32	27.20	27.20
C-1723	Base	¾ by 7¼	.....	13.32	27.20	27.20
C-1724	Base mold	¾ by 2¼	.....	4.60	7.72	7.72
C-1725	Base	¾ by 7¼	.....	13.32	27.20	27.20
C-1726	Shoe	½ by ¾	.....	1.52	2.80	2.80
C-1727	Plinth block, per 100, 1⅛ in. thick	.....	.....	13.76	28.04	28.04

These prices apply to moldings in random lengths (6 ft. long and over); when ordered in specified lengths (except 16-ft.), add 5 per cent. All 16-ft. lengths, add 10 per cent. When molding is ordered in lots of less than 500 ft. add 10 per cent. If ordered cut to special lengths, add 10 per cent.

Trim moldings, not cut to length, will be wrapped in paper only when so ordered, at a charge of 33 cts. per bundle.

Trim Prices per Side

These prices cover trim for frame jambs 5½ in. wide or less. On trim for thicker walls extra charge for jamb lining, wide stop and stool.

C-1600

Complete Window Trim Cut to Lengths for Openings

2-lt. Glass Sizes	Opening Sizes	White Pine	Unselected Birch
12 by 12 to 22 by 12	1–4 by 2– 6 to 2–2 by 2–6	$2.60	$3.92
12 by 14 to 22 by 18	1–4 by 2–10 to 2–2 by 3–6	2.96	4.48
12 by 20 to 22 by 24	1–4 by 3–10 to 2–2 by 4–6	3.36	5.08
12 by 26 to 22 by 30	1–4 by 4–10 to 2–2 by 5–6	3.72	5.64
24 by 20 to 32 by 24	2–4 by 3–10 to 3–0 by 4–6	3.60	5.48
24 by 26 to 32 by 30	2–4 by 4–10 to 3–0 by 5–6	3.96	6.04
For each extra foot in width, add		0.37	0.59
For each extra foot in height, add		0.37	0.59

Complete Door Trim Cut to Lengths for Openings. No Stop Included

Door Sizes	White Pine	Unselected Birch
2–0 by 6–8 and under	$3.56	$5.44
3–0 by 7–0	4.00	6.12
4–0 by 7–0 French doors	4.16	6.36
5–0 by 7–0 French doors	4.32	6.64
6–0 by 7–0 French doors	4.48	6.84
8–0 by 8–0 Opening	5.16	7.88
10 by 4 Colonnade opening	3.52	5.36
12 by 4 Colonnade opening	3.84	5.88
For each extra foot in width, add	0.16	0.25
For each extra foot in height, add	0.32	0.51

Intermediate sizes charged at the next higher price for all door trim.

C-1620

Complete Window Trim Cut to Lengths for Openings

2-lt. Glass Sizes	Opening Sizes	White Pine	Plain Oak	Unselected Birch
12 by 12 to 22 by 12	1–4 by 2– 6 to 2–2 by 2-6	$2.32	$3.52	$3.52
12 by 14 to 22 by 18	1–4 by 2–10 to 2-2 by 3–6	2.64	3.96	3.96
12 by 20 to 22 by 24	1–4 by 3–10 to 2-2 by 4-6	2.96	4.48	4.48
12 by 26 to 22 by 30	1–4 by 4–10 to 2-2 by 5–6	3.24	4.92	4.92
24 by 20 to 32 by 24	2–4 by 3–10 to 3–0 by 4–6	3.12	4.76	4.76
24 by 26 to 32 by 30	2–4 by 4–10 to 3–0 by 5–6	3.40	5.20	5.20
For each extra foot in width, add		0.35	0.53	0.53
For each extra foot in height, add		0.32	0.51	0.51

Complete Door Trim Cut to Lengths for Openings. No Stop Included

Door Sizes	White Pine	Plain Oak	Unselected Birch
2–0 by 6–8 and under	$ 2.72	$ 4.12	$ 4.12
3–0 by 7–0	2.84	4.28	4.28
Entrance C-100	17.16	20.84	20.84
Entrance C-101	18.00	22.00	22.00
Entrance C-103 and C-105	5.64	7.92	7.92
Entrance C-106	6.48	9.16	9.16
4–0 by 7–0 French doors	2.96	4.48	4.48
5–0 by 7–0 French doors	3.08	4.68	4.68
6–0 by 7–0 French doors	3.20	4.88	4.88
8–0 by 8–0 Opening	3.72	5.64	5.64
10 by 4 Colonnade opening	2.84	4.28	4.28
12 by 4 Colonnade opening	3.08	4.68	4.68
For each extra foot in width, add.	0.12	0.20	0.20
For each extra foot in height, add.	0.25	0.39	0.39

TRIM PRICES PER SIDE

C-1680

Complete Window Trim Cut to Lengths for Openings

2-LT. GLASS SIZES	OPENING SIZES	YELLOW PINE	PLAIN OAK
12 by 12 to 24 by 17	1–4 by 2–6 to 2–4 by 3–4	$1.68	$2.64
12 by 18 to 24 by 23	1–4 by 3–6 to 2–4 by 4–4	1.88	3.00
12 by 24 to 24 by 30	1–4 by 4–6 to 2–4 by 5–6	2.04	3.28
26 by 18 to 32 by 23	2–6 by 3–6 to 3–0 by 4–4	2.08	3.32
26 by 24 to 32 by 30	2–6 by 4–6 to 3–0 by 5–6	2.24	3.64
For each extra foot in width, add		0.21	0.36
For each extra foot in height, add		0.20	0.33

Complete Door Trim Cut to Lengths for Openings. No Stop Included

DOOR SIZES	YELLOW PINE	PLAIN OAK
2-0 by 6-8 and under	$1.68	$2.72
3-0 by 7-0	1.80	2.84
4-0 by 7-0 French doors	1.84	2.96
5-0 by 7-0 French doors	1.92	3.08
6-0 by 7-0 French doors	2.00	3.20
8-0 by 8-0 Opening	2.28	3.72
10 by 4 Colonnade opening	1.84	2.92
12 by 4 Colonnade opening	2.00	3.20
For each extra foot in width, add	0.07	0.11
For each extra foot in height, add	0.15	0.25

C-1685

Complete Window Trim Cut to Lengths for Openings

2-LT. GLASS SIZES	OPENING SIZES	YELLOW PINE	PLAIN OAK
14 by 10 to 16 by 12	1– 6 by 2–2 to 1–8 by 2–6	$1.16	$1.80
14 by 13½ to 16 by 18	1– 6 by 2–9 to 1–8 by 3–6	1.32	2.08
14 by 19½ to 16 by 24	1– 6 by 3–9 to 1–8 by 4–6	1.48	2.36
18 by 10 to 28 by 12	1–10 by 2–2 to 2–8 by 2–6	1.32	2.08
18 by 13½ to 28 by 18	1–10 by 2–9 to 2–8 by 3–6	1.48	2.36
18 by 19½ to 28 by 24	1–10 by 3–9 to 2–8 by 4–6	1.68	2.64
18 by 25½ to 28 by 30	1–10 by 4–9 to 2–8 by 5–6	1.84	2.92
For each extra foot in width, add		0.19	0.31
For each extra foot in height, add		0.19	0.31

Complete Door Trim Cut to Lengths for Openings. No Stop Included

Door Sizes	Yellow Pine	Plain Oak
2–0 by 6–8 and under	$0.92	$1.40
3–0 by 7–0	0.96	1.48
4–0 by 7–0 French doors	1.00	1.52
5–0 by 7–0 French doors	1.04	1.60
6–0 by 7–0 French doors	1.08	1.68
8–0 by 8–0 Opening	1.24	1.92
10 by 4 Colonnade opening	1.00	1.52
12 by 4 Colonnade opening	1.08	1.64
For each extra foot in width, add	0.04	0.05
For each extra foot in height, add	0.07	0.11

Trim Prices per Side

C-1640

Complete Window Trim Cut to Lengths for Openings

2-lt. Glass Sizes	Opening Sizes	White Pine	Plain Oak	Unselected Birch
12 by 12 to 22 by 12	1–4 by 2– 6 to 2–2 by 2–6	$2.24	$3.36	$3.36
12 by 14 to 22 by 18	1–4 by 2–10 to 2–2 by 3–6	2.52	3.84	3.84
12 by 20 to 22 by 24	1–4 by 3–10 to 2–2 by 4–6	2.84	4.28	4.28
12 by 26 to 22 by 30	1–4 by 4–10 to 2–2 by 5–6	3.12	4.72	4.72
24 by 20 to 32 by 24	2–4 by 3–10 to 3–0 by 4–6	3.00	4.56	4.56
24 by 26 to 32 by 30	2–4 by 4–10 to 3–0 by 5–6	3.28	5.00	5.00
For each extra foot in width, add		0.35	0.53	0.53
For each extra foot in height, add		0.31	0.48	0.48

Complete Door Trim Cut to Lengths for Openings. No Stop Included

Door Sizes	White Pine	Plain Oak	Unselected Birch
2–0 by 6–8 and under	$2.56	$3.88	$3.88
3–0 by 7–0	2.68	4.04	4.04
Entrance C-100	17.16	20.84	20.84
Entrance C-101	18.00	22.00	22.00
Entrance C-103 and C-105	5.64	7.92	7.92
Entrance C-106	6.48	9.16	9.16
4–0 by 7–0 French doors	2.80	4.24	4.24
5–0 by 7–0 French doors	2.92	4.40	4.40
6–0 by 7–0 French doors	3.04	4.60	4.60
8–0 by 8–0 Opening	3.52	5.32	5.32
10 by 4 Colonnade opening	2.68	4.04	4.04
12 by 4 Colonnade opening	2.92	4.40	4.40
For each extra foot in width, add	0.12	0.20	0.20
For each extra foot in height, add	0.24	0.36	0.36

C-1650

Complete Window Trim Cut to Lengths for Openings

2-lt. Glass Sizes	Opening Sizes	Yellow Pine	Plain Oak
12 by 12 to 22 by 12	1–4 by 2- 6 to 2–2 by 2–6	$2.00	$3.24
12 by 14 to 22 by 18	1–4 by 2–10 to 2–2 by 3–6	2.28	3.72
12 by 20 to 22 by 24	1–4 by 3–10 to 2–2 by 4–6	2.60	4.20
12 by 26 to 22 by 30	1–4 by 4–10 to 2–2 by 5–6	2.88	4.68
24 by 20 to 32 by 24	2–4 by 3–10 to 3–0 by 4–6	2.80	4.52
24 by 26 to 32 by 30	2–4 by 4–10 to 3–0 by 5–6	3.08	5.00
For each extra foot in width, add		0.28	0.48
For each extra foot in height, add		0.31	0.51

Complete Door Trim Cut to Lengths for Openings. No Stop Included

Door Sizes	Yellow Pine	Plain Oak
2–0 by 6–8 and under	$2.44	$3.96
3–0 by 7–0	2.56	4.16
4–0 by 7–0 French doors	2.68	4.32
5–0 by 7–0 French doors	2.80	4.52
6–0 by 7–0 French doors	2.88	4.62
8–0 by 8–0 Opening	3.36	5.48
10 by 4 Colonnade opening	2.40	3.84
12 by 4 Colonnade opening	2.60	4.24
For each extra foot in width, add	0.12	0.20
For each extra foot in height, add	0.21	0.36

Trim Prices per Side

C-1660

Complete Window Trim Cut to Lengths for Openings

2-lt. Glass Sizes	Opening Sizes	Yellow Pine	Plain Oak	Unselected Birch
12 by 12 to 22 by 12	1–4 by 2– 6 to 2–2 by 2–6	$2.28	$3.72	$3.72
12 by 14 to 22 by 18	1–4 by 2–10 to 2–2 by 3–6	2.64	4.28	4.28
12 by 20 to 22 by 24	1–4 by 3–10 to 2–2 by 4–6	2.96	4.84	4.84
12 by 26 to 22 by 30	1–4 by 4–10 to 2–2 by 5–6	3.28	5.36	5.36
24 by 20 to 32 by 24	2–4 by 3–10 to 3–0 by 4–6	3.20	5.24	5.24
24 by 26 to 32 by 30	2–4 by 4–10 to 3–0 by 5–6	3.52	5.76	5.76
For each extra foot in width, add		0.33	0.56	0.56
For each extra foot in height, add		0.33	0.56	0.56

Complete Door Trim Cut to Lengths for Openings. No Stop Included

Door Sizes	Yellow Pine	Plain Oak	Unselected Birch
2–0 by 6–8 and under	$2.88	$4.68	$4.68
3–0 by 7–0	3.00	4.92	4.92
Entrance C-100	14.48	18.56	18.56
Entrance C-101	15.00	19.28	19.28
Entrance C-103 and C-105	6.12	8.60	8.60
Entrance C-106	6.92	9.88	9.88
4–0 by 7–0 French doors	3.16	5.16	5.16
5–0 by 7–0 French doors	3.28	5.40	5.40
6–0 by 7–0 French doors	3.44	5.60	5.60
8–0 by 8–0 Opening	4.00	6.56	6.56
10 by 4 Colonnade opening	3.08	5.04	5.04
12 by 4 Colonnade opening	3.36	5.52	5.52
For each extra foot in width, add	0.13	0.23	0.23
For each extra foot in height, add	0.28	0.48	0.48

C-1670

Complete Window Trim Cut to Lengths for Openings

2-lt. Glass Sizes	Opening Sizes	Yellow Pine
12 by 12 to 22 by 12	1–4 by 2– 6 to 2–2 by 2–6	$2.08
12 by 14 to 22 by 18	1–4 by 2–10 to 2–2 by 3–6	2.32
12 by 20 to 22 by 24	1–4 by 3–10 to 2–2 by 4–6	2.60
12 by 26 to 22 by 30	1–4 by 4–10 to 2–2 by 5–6	2.80
24 by 20 to 32 by 24	2–4 by 3–10 to 3–0 by 4–6	2.84
24 by 26 to 32 by 30	2–4 by 4–10 to 3–0 by 5–6	3.08
For each extra foot in width, add		0.35
For each extra foot in height, add		0.24

Complete Door Trim Cut to Lengths for Openings. No Stop Included

Door Sizes	Yellow Pine
2–0 by 6–8 and under	$2.24
3–0 by 7–0	2.40
4–0 by 7–0 French doors	2.56
5–0 by 7–0 French doors	2.72
6–0 by 7–0 French doors	2.88
8–0 by 8–0 Opening	3.36
10 by 4 Colonnade opening	2.76
12 by 4 Colonnade opening	3.08
For each extra foot in width, add	0.20
For each extra foot in height, add	0.19
Door and window caps put together for openings up to 4 ft. 6 in. wide, add	0.64

Trim Prices per Side

C-1690 and C-1700

Complete Window Trim Cut to Lengths for Openings

2-lt. Glass Sizes	Opening Sizes	Yellow Pine	Plain Oak	Unselected Birch
12 by 12 to 22 by 12	1–4 by 2– 6 to 2–2 by 2–6	$2.68	$4.40	$4.40
12 by 14 to 22 by 18	1–4 by 2–10 to 2–2 by 3–6	3.00	4.92	4.92
12 by 20 to 22 by 24	1–4 by 3–10 to 2–2 by 4–6	3.32	5.44	5.44
12 by 26 to 22 by 30	1–4 by 4–10 to 2–2 by 5–6	3.68	6.00	6.00
24 by 20 to 32 by 24	2–4 by 3–10 to 3–0 by 4–6	3.60	5.92	5.92
24 by 26 to 32 by 30	2–4 by 4–10 to 3–0 by 5–6	3.92	6.44	6.44
For each extra foot in width, add		0.33	0.56	0.56
For each extra foot in height, add		0.35	0.59	0.59

Complete Door Trim Cut to Lengths for Openings. No Stop Included

Door Sizes	Yellow Pine	Plain Oak	Unselected Birch
2–0 by 6–8 and under	$2.80	$4.60	$4.60
3–0 by 7–0	2.96	4.84	4.84
4–0 by 7–0 French doors	3.08	5.04	5.04
5–0 by 7–0 French doors	3.20	5.24	5.24
6–0 by 7–0 French doors	3.36	5.52	5.52
8–0 by 8–0 opening	3.88	6.40	6.40
10 by 4 Colonnade opening	3.08	5.04	5.04
12 by 4 Colonnade opening	3.36	5.52	5.52
For each extra foot in width, add	0.15	0.25	0.25
For each extra foot in height, add	0.28	0.48	0.48

C-1710

Complete Window Trim Cut to Lengths for Openings

2-lt. Glass Sizes	Opening Sizes	Yellow Pine		Plain Oak		Unselected Birch	
		With C-1716 Casing	With C-1721 Casing	With C-1716 Casing	With C-1721 Casing	With C-1716 Casing	With C-1721 Casing
12 by 12 to 22 by 12	1–4 by 2– 6 to 2–2 by 2–6	$2.52	$2.60	$4.12	$4.24	$4.12	$4.24
12 by 14 to 22 by 18	1–4 by 2–10 to 2–2 by 3–6	2.76	2.84	4.48	4.64	4.48	4.64
12 by 20 to 22 by 24	1–4 by 3–10 to 2–2 by 4–6	2.96	3.08	4.80	5.04	4.80	5.04
12 by 26 to 22 by 30	1–4 by 4–10 to 2–2 by 5–6	3.16	3.32	5.16	5.44	5.16	5.44
24 by 20 to 32 by 24	2–4 by 3–10 to 3–0 by 4–6	3.16	3.28	5.16	5.40	5.16	5 40
24 by 26 to 32 by 30	2–4 by 4–10 to 3–0 by 5–6	3.36	3.52	5.52	5.80	5.52	5 80
For each extra foot in width, add		0.48	0.51	0.81	0.84	0.81	0.84
For each extra foot in height, add		0.20	0.21	0.33	0.36	0.33	0.36

Complete Door Trim Cut to Lengths for Openings. No Stop Included

Door Sizes	Yellow Pine		Plain Oak		Unselected Birch	
	C-1716 Casing	C-1721 Casing	C-1716 Casing	C-1721 Casing	C-1716 Casing	C-1721 Casing
2–0 by 6–8 and under	$2.20	$2.48	$3.56	$4.00	$3.56	$4.00
3–0 by 7–0	2.40	2.68	3.92	4.32	3.92	4.32
4–0 by 7–0 French doors	2.60	2.88	4.24	4.68	4.24	4.68
5–0 by 7–0 French doors	2.80	3.08	4.60	5.00	4.60	5.00
6–0 by 7–0 French doors	3.00	3.28	4.92	5.32	4.92	5.32
8–0 by 8–0 Opening	3.56	3.84	5.84	6.32	5.84	6.32
10 by 4 Colonnade opening	3.12	3.24	5.12	5.28	5.12	5.28
12 by 4 Colonnade opening	3.52	3.64	5.80	5.96	5.80	5.96
For each extra foot in width, add	0.20	0.21	0.33	0.36	0.33	0.36
For each extra foot in height, add	0.15	0.17	0.25	0.28	0.25	0.28
Door and window caps put together for openings up to 4–6 wide, add						$0.76

CHAPTER XIII

FURRING, LATHING AND PLASTERING

Furring.—Furring is a support for lath and plaster and is used where the lines of the finished work are other than those of the structural elements. Furring is also used to prevent plaster from coming in contact with walls where there is a possibility of moisture injuring the finished work. For this purpose wood furring strips or light steel angles, tees, channels or bars are used. These are fastened with nails, staples, or bolts. For ornamental work, wood furring is

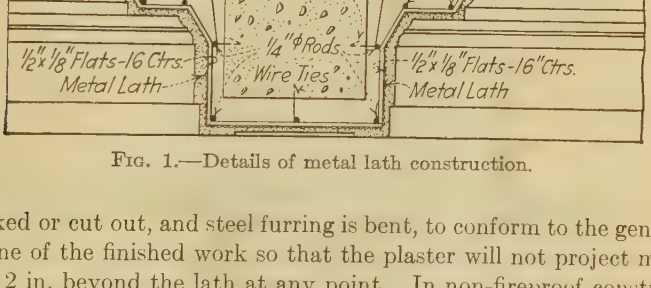


Fig. 1.—Details of metal lath construction.

blocked or cut out, and steel furring is bent, to conform to the general outline of the finished work so that the plaster will not project more than 2 in. beyond the lath at any point. In non-fireproof construction where the exterior masonry work is furred for dampproofing, the walls are first coated with a waterproofing compound. Wood furring strips, usually about 1 by 2 in. are then nailed on, spaced from 12 to 24 in. on centers. Furring for wood lath should be spaced 12, or 16 in. on centers.

A false beam and suspended ceiling placed below a reinforced concrete floor. The wire and ¼-in. rod hangers are placed before the concrete is poured. The frame for the suspended ceiling is supported by ¼-in. rod hangers. The forming of the brackets is done on the job. (See Fig. 1.)

An ornamental plaster beam and cornice placed over a concrete beam. The wire ties supporting the frame are placed before pouring the concrete. The holes to receive the ends of the brackets are drilled after the forms are removed. (See Fig. 2.)

Wood Lath.—Wood laths are manufactured in 48-in. lengths, 1½ in. wide and ⅜ in. thick. They are put up in bundles of 100 and sold

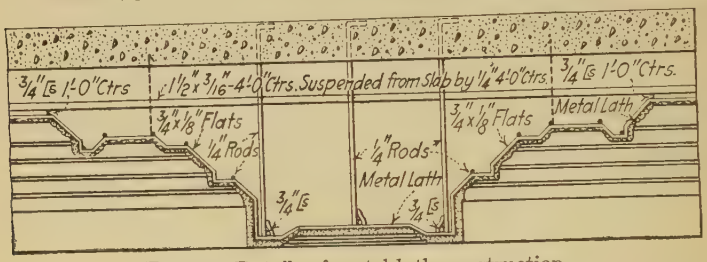


Fig. 2.—Details of metal lath construction.

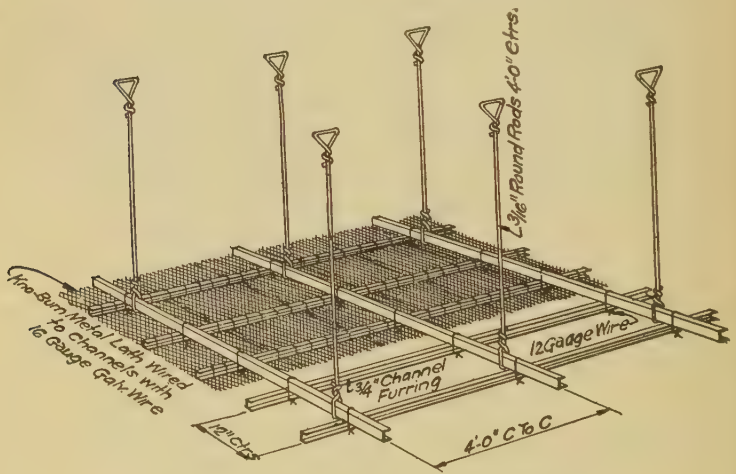


Fig. 3.—Method of framing for suspended ceiling.

by the thousand. They should be well seasoned and free from sap, bark and dead knots, as bark and pitch will stain the plaster. The woods customarily used are white pine, spruce, hemlock, and cypress. Laths for lime plaster should be spaced ¼ in. and for gypsum wall plaster 3/16 in. apart. Wood laths should be wet thoroughly several hours before the plaster is applied. Otherwise they will absorb the

water from the plaster causing dry spots before the plaster has set and by swelling after the plaster has been applied, will cause cracks.

Byrkit Lath.—A sheathing called "Byrkit Lath" is made by cutting keyed grooves in the face of square edge sheathing boards, eliminating the furring and lathing for exterior stucco. The stock sizes are ¾ in. thick by 3½ or 5¼ in. wide, in lengths of 4 ft. and upward. The labor required for applying is the same as for common sheathing.

Bishopric.—Bishopric is a combination of materials. The base, consisting of heavy tough fiber board, is coated with asphalt mastic, which makes it proof against moisture, heat, cold, air or sound. It is also vermin and fire resisting. Wood strips are imbedded into the layer of asphalt mastic under pressure. (See Fig. 4.)

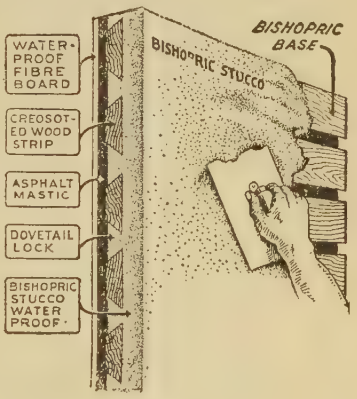


Fig. 4.

Bishopric Stucco and Plaster Base has wood strips or lath with beveled edges which form a dovetail key for the plaster, stucco, or mortar for brick veneer. This form of construction is very economical in plaster or stucco material as there is no waste due to droppings.

Bishopric Sheathing has square edge strips and is made for use under siding, shingles, roofing, and subflooring.

Types and Uses of Bishopric Stucco and Plaster Base.—Medium Weight, standard key, made of selected wood strips ⅜ in. thick, well-seasoned, creosoted or not creosoted. When creosoted, this type is especially recommended for exterior cement stucco and brick veneer. When not creosoted it is satisfactory for exterior cement stucco and brick veneer.

Medium Weight, has a narrow key made of selected wood strips ⅜ in. thick, well-seasoned, is especially adapted for magnesite stucco and all interior plastering.

Heavy Weight, is made of selected wood strips ⅝ in. thick, well-seasoned, creosoted or untreated, made with standard key or narrow key as desired.

Types and Uses of Bishopric Sheathing.—*Medium Weight*, made of well-seasoned selected wood strips $\frac{3}{8}$ in. thick, creosoted or not creosoted.

Heavy Weight, made of well-seasoned selected wood strips $\frac{5}{8}$ in. thick, creosoted or not creosoted.

These types are recommended for side walls under sidings, side walls under shingles, subflooring and as roof boards under shingles and roofing.

Bishopric Insulating Base for Sound Deadening and Insulation.—*Insulating Base.* This base has felt backing in place of the fiber board backing which is used in the standard Bishopric base. This type is especially adapted for conditions where special insulation features are desired. It is made with standard or narrow key $\frac{3}{8}$ or $\frac{5}{8}$ in. thick and is creosoted or untreated.

All types of Bishopric can be supplied with heavy felt background instead of fiber board where special insulation features are desired. Standard rolls are 4 ft. wide and 25 ft. long, containing 100 sq. ft., weighing 90 lb. per roll for the medium weight and 130 lb. for the heavy weight.

A similar product is made by the Flaxlinum Insulating Company, St. Paul, Minn.

List Prices (January 1, 1923)

	Per 1,000 Sq. Ft.
Bishopric stucco or plaster base, medium weight (not creosoted)	$50
Bishopric stucco or plaster base, medium weight (creosoted)	55
Bishopric stucco or plaster base, medium weight, narrow key (not creosoted)	55
Bishopric stucco or plaster base, medium weight, narrow key (creosoted)	60
Bishopric stucco or plaster base, heavy weight (not creosoted)	60
Bishopric stucco or plaster base, heavy weight (creosoted)	65
Bishopric stucco or plaster base, heavy weight, narrow key (not creosoted)	65
Bishopric stucco or plaster base, heavy weight, narrow key (creosoted)	70
Bishopric insulating base (heavy felt backing), medium weight (not creosoted)	75
Bishopric insulating base (heavy felt backing), medium weight, narrow key	80
Bishopric sheating (heavy weight)	45
Bishopric sheathing (heavy weight creosoted)	50
Bishopric sheathing (medium weight)	40
Bishopric sheathing (medium weight creosoted)	45

Wire Lath.—There are several types of wire lath, the most common being a woven wire fabric of No. 18 to No. 21 gauge wire spaced 2½ meshes to the inch. It is made in three grades; uncoated, japanned, and galvanized. The galvanized lath is slightly stiffer than the others, permitting a slight reduction in the size of the wire.

Another type of wire lath is made by placing the cross wires on the longitudinals and fastening them in place with metal clips or an electrical weld.

Wire lath to form a firm support for plastering must be stretched tight. To avoid the labor necessary for stretching plain wire lath tight enough, stiffened wire lath is sometimes used. This consists of wire lath with rods, angles or other forms of stiffeners fastened to the mesh crosswise. The stiffeners also act as additional cross furring.

Method of Applying Wire Lath.—In applying wire lath to metal furring the lath should be tied in place and drawn tight to the furring with No. 18 gage annealed galvanized wire lacing. The tie wires should be given a double turn and the raw ends bent back flush with the face of the lath. Plain lath should be wired along each furring bar at about 6-in. intervals and stiffened lath should have each stiffener securely tied to each furring bar. All end joints should be lapped at least 1 in. and the joints in adjacent sheets should be alternated so that they will not occur in the same line. Side joints should be lapped in such a way as to insure continuity of the lathed surface and should as a rule have a lap of not less than ½ in. Side laps should preferably be made along a furring bar or support, but if made between furring they should be thoroughly laced together.

In applying wire lath to wooden supports, either against sheathing or to bare studs in walls and partitions, or against joists as in ceilings, the lath should be securely stapled in place with galvanized wire staples. These should be driven down so as to bring the lath to a secure bearing against the supporting background. In applying plain lath to a wooden furring, it should be stapled along each furring strip at intervals of about 6 in. and stiffened lath should have each stiffener stapled to each stud or joist. In case stiffened lath is applied directly to sheathing, each stiffener should be stapled both at the sides and at the center of the sheet.

In the following table are given the quantities of wire lacing or wire staples required to apply 100 sq. yd., of wire lath with various spacings of furring. In this table it is assumed that plain lath is wired or stapled to each furring strip at 6-in. intervals along its length, while stiffened lath is wired or stapled to each furring strip at 8-in. intervals along its length. The wire lacing for connection to metal furring is in each case No.18 annealed galvanized wire and the staples

are galvanized wire staples, ¾-in. No. 14 round top for plain lath and 1¼-in. No. 13 square top for stiffened lath.

LACING WIRE AND STAPLES REQUIRED TO APPLY 100 SQ. YD. OF WIRE LATH

Spacing of furring	Plain lath		V-stiffened lath	
	No. 18 galvanized wire lacing, pounds	¾-in. No. 14 galvanized wire staples, pounds	No. 18 galvanized wire lacing, pounds	1¼-in. No. 13 galvanized wire staples, pounds
12 in. c/c	6	4	5½	9½
14 in. c/c	5	3½	4½	8
16 in. c/c	4½	3	4	7
	...	...	3½	6

SHIPPING WEIGHTS OF CLINTON WIRE LATH

Gage of wire	Weight of one roll of plain lath containing 200 lin. ft., 36 in. wide		Weight of one roll of V-stiffened lath containing 100 lin. ft., 36 in. wide	
	Japanned, pounds	Galvanized, pounds	Japanned, pounds	Galvanized, pounds
No. 18	215	270	135	175
No. 19	165	210	110	145
No. 20	120	165	90	125
No. 21	100	140	80	110

Expanded Metal Lath.—Expanded metal lath is made from plain or ribbed sheet steel which has been slit and then expanded to form openings for the plaster key. Various patterns are made by the different manufacturers such as diamond, herringbone, etc. It is fastened to wood supports with staples and to metal supports with No. 18 gage annealed galvanized lacing wire. Expanded metal lath is manufactured in sheets and sold by the bundle, each bundle containing from 10 to 30 sq. yd. Sheets can be bent at the factory to any radius over 12 in. (See Fig. 6.)

The following table was compiled from manufacturers' catalogues, giving the types of lath in common use, no attempt having been made to list all makes on the market:

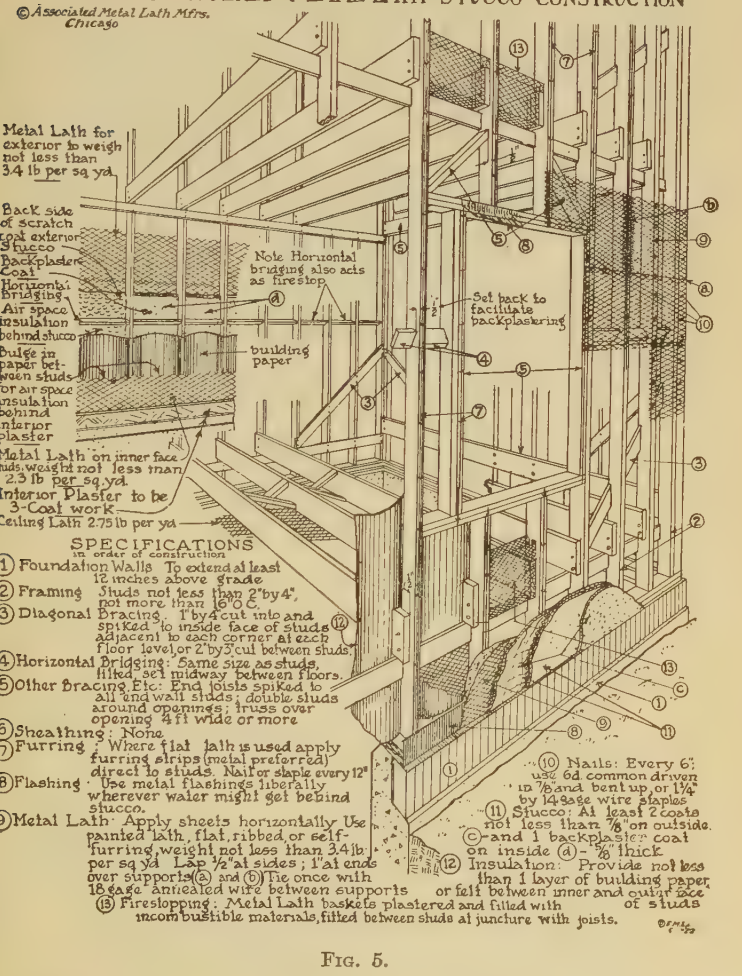

BACK-PLASTERED METAL LATH STUCCO CONSTRUCTION
© Associated Metal Lath Mfrs. Chicago
Metal Lath for exterior to weigh not less than 3.4 lb per sq yd
Back side of scratch coat exterior Stucco
Backplaster Coat
Horizontal bridging
Air space insulation behind stucco
Bulge in paper between studs for air space insulation behind interior plaster
Metal Lath on inner face studs, weight not less than 2.3 lb per sq yd.
Interior Plaster to be 3-Coat work
Ceiling Lath 2.75 lb per yd
Note Horizontal bridging also acts as firestop
building paper
Set back to facilitate backplastering
SPECIFICATIONS
in order of construction
(1) Foundation Walls To extend at least 12 inches above grade
(2) Framing Studs not less than 2"by4", not more than 16" O.C.
(3) Diagonal Bracing 1"by4" cut into and spiked to inside face of studs adjacent to each corner at each floor level or 2"by3" cut between studs.
(4) Horizontal Bridging Same size as studs, filled, set midway between floors.
(5) Other Bracing Etc: End joists spiked to all end wall studs; double studs around openings; truss over opening 4 ft wide or more
(6) Sheathing None
(7) Furring Where flat lath is used apply furring strips (metal preferred) direct to studs. Nail or staple every 12"
(8) Flashing Use metal flashings liberally wherever water might get behind stucco.
(9) Metal Lath Apply sheets horizontally Use painted lath, flat, ribbed or self-furring, weight not less than 3.4 lb per sq yd Lap ½" at sides; 1" at ends over supports (a) and (b) Tie once with 18 gage annealed wire between supports
(13) Firestopping Metal Lath baskets plastered and filled with incombustible materials, fitted between studs at juncture with joists.
(10) Nails: Every 6" use 6d common driven in ⅞ and bent up, or 1¼" by 14 gage wire staples
(11) Stucco: At least 2 coats not less than ⅞" on outside (c) and 1 backplaster coat on inside (d) - ⅝" thick
(12) Insulation: Provide not less than 1 layer of building paper or felt between inner and outer face of studs

FIG. 5.

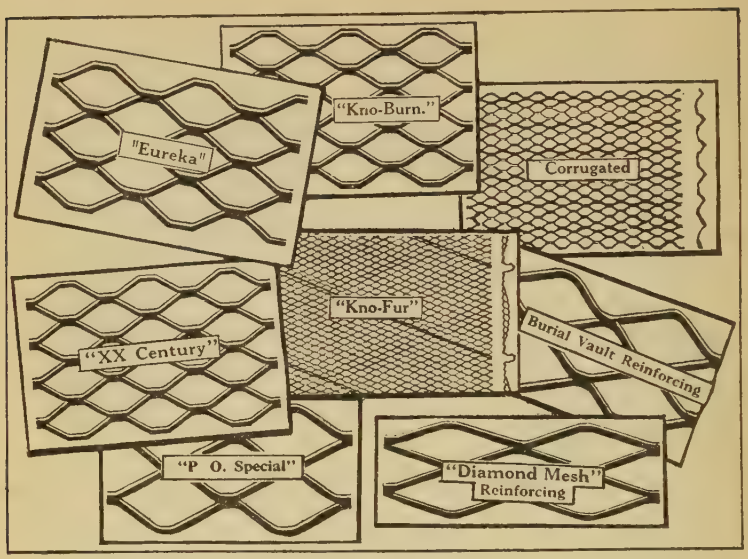

"Eureka"
"Kno-Burn."
Corrugated
"Kno-Fur"
"XX Century"
Burial Vault Reinforcing
"P O. Special"
"Diamond Mesh"
Reinforcing

FIG. 6.

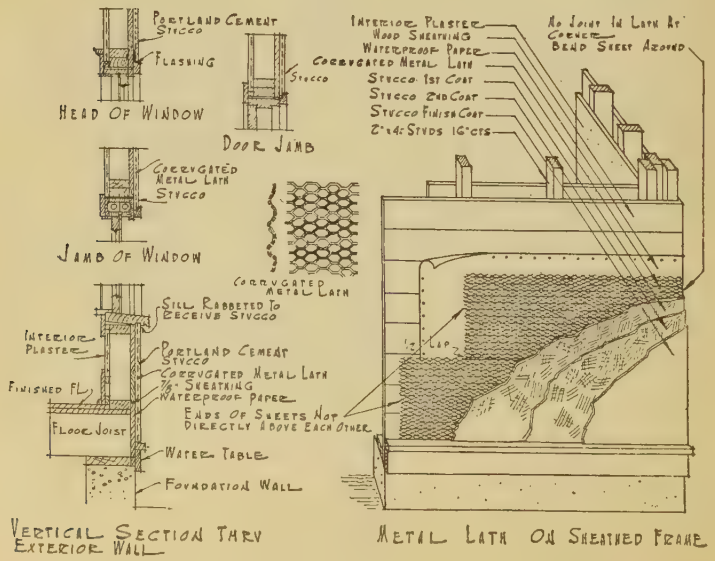

Portland Cement Stucco
Flashing
Head of Window
Stucco
Door Jamb
Corrugated Metal Lath
Stucco
Jamb of Window
Corrugated Metal Lath
Sill Rabbeted to Receive Stucco
Interior Plaster
Portland Cement Stucco
Corrugated Metal Lath
Finished Fl.
½" Sheathing
Waterproof Paper
Floor Joist
Ends of Sheets Not Directly Above Each Other
Water Table
Foundation Wall
Vertical Section Thru Exterior Wall
Interior Plaster
Wood Sheathing
Waterproof Paper
Corrugated Metal Lath
Stucco 1st Coat
Stucco 2nd Coat
Stucco Finish Coat
2"x4" Studs 16" cts
No Joint in Lath at Corner
Bead Sheet Around
Lap
Metal Lath on Sheathed Frame

FIG. 7.

Trade name	Made by		Gage	Mesh, in.	Ribs		Size of sheet	Bundle		Wt. S.Y.
					Height, in.	Centers, in.		Sheets	S.Y.	
Rib-plex	Berger Mfg. Company.	Phila., Pa.	24	3/8	3/8	8	24 by 96 in.	9	16	4.08
			26	3/8	3/8	8				3.06
			28	3/8	3/8	8				2.55
Rib-plex	Berger Mfg. Company.	Phila., Pa.	24	3/4	3/4	4.67	24 in. by 4 to 12 ft.	9		
			26	3/4	3/4	4.67				
			28	3/4	3/4	4.67				
Diamond mesh, standard.	Berger Mfg. Company.	Phila., Pa.	24				22 by 96 in.			2.8
			26				21 by 96 in.			2.2
Truss loop	Bostwick Steel Lath Company.	Niles, O.					13.5 by 96 in.	10	10	4.5
							16.5 by 80 in.	10	10	4.5
							24 by 96 in.	9	16	4.5
							27 by 96 in.	10	20	4.5
Diamond A	Bostwick Steel Lath Company.	Niles, O.	24				14 by 96 in.	10	10	4.00
			27				14 by 96 in.			2.75
Niles	Bostwick Steel Lath Company.	Niles, O.	22	3/8 by 3/4			24 by 96 in.	9	16	4.0
			24				24 by 96 in.	9	16	3.4
			26				24 by 96 in.	9	16	2.5
			27				24 by 96 in.	9	16	2.3
			Also furnished in sheets				18 by 96 in.	9	12	
Lock	Bostwick Steel Lath Company.	Niles, O.	24				22 by 96 in.	9	14.7	2.8
			26				21 by 96 in.	9	14.0	2.2
Steelcrete	Consolidated Expanded Metal Company.	Braddock, Pa.	22P				24 by 96 in.	10	17.17	4.37
			24F				24 by 96 in.	15	26.66	3.40
			25F				24 by 96 in.	15	26.66	3.00
			26F				24 by 96 in.	15	26.66	2.55
			27F				24 by 96 in.	15	26.66	2.33
			24H				28 by 96 in.	14	29.00	2.90
			26H				28 by 96 in.	14	29.00	2.20

EXPANDED METAL LATH.—(*Continued*)

Trade name	Made by		Ga.	Mesh, in.	Ribs		Size of sheet	Bundle		Wt. S.Y.
					Height, in.	Centers, in.		Sheets	S.Y.	
Rib mesh	Consolidated Expanded Metal Company.	Braddock, Pa.	24		3/4	3 1/4	13 in. by 6, 8, 10, 12 ft.	..		8.73
			26		3/4	3 1/4	13 in. by 6, 8, 10, 12 ft.	..		6.57
			28		3/4	3 1/4	13 in. by 6, 8, 10, 12 ft.	..		5.49
			24		5/16	3	18 in. by 8 and 12 ft.	..		5.58
			26		5/16	3	18 in. by 8 and 12 ft.	..		4.23
			28		5/16	3	18 in. by 8 and 12 ft.	..		3.51
Corrugated mesh	Corrugated Bar Company	Buffalo, N. Y.	24		3/4	3 1/4	13 in. by 6, 8, 10, 12 ft.	..		8.73
			26		3/4	3 1/4	13 in. by 6, 8, 10, 12 ft.	..		5.67
			28		3/4	3 1/4	13 in. by 6, 8, 10, 12 ft.	..		5.49
			24		5/16	3	18 in. by 8 and 12 ft.	..		5.58
			26		5/16	3	18 in. by 8 and 12 ft.	..		4.23
			28		5/16	3	18 in. by 8 and 12 ft.	..		3.51
"Self-centering"	General Fireproofing Company.	Youngstown, O.	24		1 1/16	3 5/8	29 in. by 4 to 12 ft.	..		8.37
			26		1 1/16	3 5/8	29 in. by 4 to 12 ft.	..		6.30
			28		1 1/16	3 5/8	29 in. by 4 to 12 ft.	..		5.22
"Trussit"	General Fireproofing Company.	Youngstown, O.	24		3/4	1 1/2	19 in by 8, 10, 12 ft.	..		7.47
			26		3/4	1 1/2	19 in by 8, 10, 12 ft.	..		5.58
			28		3/4	1 1/2	19 in by 8, 10, 12 ft.	..		5.13
Herringbone BB	General Fireproofing Company.	Youngstown, O.	22	3/8	....	1 1/4	20 1/4 in. by 8 ft.	..		4.21
			24	3/8	....	1 1/4	20 1/4 in. by 8 ft.	..		3.37
			26	3/8	....	1 1/4	20 1/4 in. by 8 ft.	..		2.50
			27	3/8	....	1 1/4	.....	..		2.25
			24	3/8	....	1 1/2	18 in. by 8 ft.	..		3.79
			26	3/8	....	1 1/2	18 in. by 8 ft.	..		2.81
			27	3/8	....	1 1/2	18 in. by 8 ft.	..		2.53

Key	General Fireproofing Company.	Youngstown, O.	22	1 by ¾	....	.....	24 in. by 8 ft.	..	....	4.0
			24	1 by ¾	....	.....	24 in. by 8 ft.	..	....	3.4
			25	1 by ⅜	....	.....	24 in. by 8 ft.	..	....	3.05
			26	1 by ¾	....	.....	24 in. by 8 ft.	..	....	2.5
			27	1 by ¾	....	.....	24 in. by 8 ft.	..	....	2.3
Kno-burn	N. W. Expanded Metal Lath Company.	Youngstown, O.	24	.....	....	.....	24 by 96 in.	9	16	3.4
			25	.....	....	.....	24 by 96 in.	9	16	3.0
			26	.....	....	.....	24 by 96 in.	9	16	2.5
			27	.....	....	.....	24 by 96 in.	9	16	2.3
Eureka and XX Century.	N. W. Expanded Metal Lath Company.	Youngstown, O.	24	⅞ by 7/16	....	.....	22 by 96 in.	9	14.7	2.8
			26	⅞ by 7/16	....	.....	21 by 96 in.	9	14.0	2.2
P. O. special	N. W. Expanded Metal Lath Company.	Youngstown, O.	22	.....	....	.....	24 by 96 in.	9	16	4.3
Diamond mesh	N. W. Expanded Metal Lath Company.	Youngstown, O.	24	1⅛ by 5/16	....	.....	21 by 96 in.	9	14	3.3
			26	1⅛ by 5/16	....	.....	24 by 96 in.	9	16	2.3
Kno-fur	N. W. Expanded Metal Lath Company.	Youngstown, O.	24	Reg.	½	Diag.	22 by 96 in.	9	14.7	3.82
			24	Spec.	½	Diag.	20½ by 96 in.	9	13.7	3.15
			26	Spec.	½	Diag.	19½ by 96 in.	9	13.0	2.4
			27	Reg.	....	.....	22 by 96 in.	9	14.7	2.72
Expanded cup	Sykes Metal Lath & Roofing Co.	Niles, O.	24	.....	...	.....	18 by 96 in.	15	20	3.6
			26	.....	....	.....	18 by 96 in.	15	20	2.9
			27	.....	....	.....	18 by 96 in.	15	20	2.7
Economy	Sykes Metal Lath & Roofing Company.	Niles, O.	24	.....	....	.....	24 by 96 in.	9	16	2.9
			26	.....	....	.....	24 by 96 in.	9	16	2.1
Diamond mesh	Sykes Metal Lath & Roofing Company.	Niles, O.	24	.....	....	.....	24 by 96 in.	9	16	3.4
			26	.....	....	.....	24 by 96 in.	9	16	2.5
			27	.....	....	.....	24 by 96 in.	9	16	2.3

EXPANDED METAL LATH.—(*Continued*)

Trade name	Made by		Ga.	Mesh. in.	Ribs		Size of sheet	Bundle		Wt. S.Y.
					Height, in.	Centers, in.		Sheets	S.Y.	
Trough sheet	Sykes Metal Lath & Roofing Company.	Niles, O.	..	.....	....	.....	13½ by 96 in.	10	10.0	4.5
			..	.....	....	.....	23½ by 96 in.	9	15.7	4.5
Sure key	Sykes Metal Lath & Roofing Company.	Niles, O.	24	.....	....	.....	18 by 96 in.	15	20	3.6
			26	.....	....	.....	18 by 96 in.	15	20	2.8
			27	.....	....	.....	18 by 96 in.	15	20	2.6
Hy-rib	Truscon Steel Company.	Youngstown, O.	24	.....	⅜	4	24 in. by 6, 8, 10, 12 ft.	18	....	4.77
			26	.....	⅜	4	24 in. by 6, 8, 10, 12 ft.	..	....	3.6
			28	.....	⅜	4	24 in. by 6, 8, 10, 12 ft.	..	....	2.97
			24	.....	15/16	4	28 in. by 6, 8, 10, 12 ft.	8	....	8.37
			26	.....	15/16	4	28 in. by 6, 8, 10, 12 ft.	..	....	6.3
			28	.....	15/16	4	28 in. by 6, 8, 10, 12 ft.	..	....	5.22
A-1 Hy-rib	Truscon Steel Company.	Youngstown, O.	..	.....	....	.....	18 by 96 in.	15	20	3.2
Standard Rib No. 2.	Truscon Steel Company.	Youngstown, O.	..	.....	....	.....	27 by 96 in.	15	30	2.7
Standard Rib No 4.	Truscon Steel Company.	Youngstown, O.	..	.....	....	.....	27 by 96 in.	15	30	3.2
Truscon diamond	.....	.....	22	.....	....	.....	24 by 96 in.	15	26.7	4.2
			24	.....	....	.....	27 by 96 in.	10	20.0	3.4
			25	.....	....	.....	27 by 96 in.	10	20.0	3.0
			26	.....	....	.....	27 by 96 in.	10	20.0	2.55
			27	.....	....	.....	27 by 96 in.	10	20.0	2.33
Universal diamond	.....	.....	24	.....	....	.....	27 by 96 in.	10	20.0	2.8
			26	.....	....	.....	27 by 96 in.	10	20.0	2.2

Estimating Furring and Lathing.—In estimating furring and lathing, actual areas are taken. Items necessitating additional labor, such as corners, cornices, and other special work, should be taken off separately and the labor hours applied as indicated in the table. The time given is only for the erection or application of the various items listed, and does not include staging, scaffolding or other preparatory work.

Plaster.—Plaster is a mixture of sand or other fine aggregate with a binder of lime, gypsum (plaster of Paris) or cement, and hair or fiber. The customary method of application on a wood or metal lath base is to apply it in two or three coats. These coats consist of scratch coat, brown coat, and finish or skim coat. When applied to masonry the scratch coat is omitted.

Scratch Coat.—The scratch coat is applied to the lath and forced through to form a key or clinch at the rear of the lath. This coat is made rich in lime and hair, as the strength of the entire plaster work depends on the holding properties of the scratch coat. Before this coat sets hard it is scratched, to form a key for the brown coat, from which operation it derives its name.

Brown Coat.—The brown coat is applied to the scratch coat, and is the leveling or truing coat. It is floated up to within $\frac{1}{8}$ in. of the finished surface or grounds, plumbed and rodded to correct any irregularities in the scratch coat. In the better grade of work plaster bands about 6 in. wide, called "screeds," are applied horizontally and vertically, about 6 ft. apart, carefully plumbed and rodded, to form a guide for the body of the coat which is then floated up to the surface of the screeds.

Finish Coat.—The finish coat, also called the white coat, skim coat, sand finish, etc., is applied over the brown coat and brought to the face of the grounds. The amount of work required on this coat is one of the governing factors in the cost of the job. The longer it is worked with a trowel the harder and smoother it becomes, and in first-class work only expert mechanics should be employed on this coat.

Fine Aggregate.—The fine aggregate used depends on the coat and the finish desired. Coarse sand is used for the scratch and brown coats and also for "sand float" finish coats. Washed white beach sand is used for smooth finish and marble dust for smooth hard finish coats. Hair, Manila fiber, jute, asbestos and wood fiber are used in

FURRING AND LATHING, MATERIAL AND LABOR REQUIRED TO COVER 100 SQ. YD.

Class of work	Kind of material	Centers, inches	Furring, pounds	Lath, square yards	Labor, hours
Furring and lathing					
Beams and girders	1- by 3/16-in. bar iron and metal lath	12	710	105	80
		16	570	105	66
Metal partitions	1- by 1- by 1/8-in. angles and metal lath	12	850	105	42
		16	680	105	32
Ceilings with furring clipped to beams	1-in. channels and metal lath	12	940	105	25
		16	720	105	20
Hung ceilings, including purlins, clips, etc	1-in. channels and metal lath	12	1,280	105	33
		16	1,020	105	25
Heavy cornice and false beam	1- by 3/16-in. bar iron and metal lath	12	710	105	100
Semicircular or segmental ceilings	1- by 3/16-in. bar iron and metal lath	12	710	105	100
Groined arches, domes, etc	1- by 3/16-in. bar iron and metal lath	12	1,170	125	178
Metal lath			Staples		
Ceilings and partitions stapled on wood	Metal lath and staples	12	5	105	12
		16	5	105	9
Coves and cornices stapled on wood	Metal lath and staples	12	5	105	22
		16	5	105	18
Beams and girders stapled on wood	Metal lath and staples	12	5	105	22
		16	5	105	18
Wood lath			Nails	Number	
Partitions and ceilings	Wood lath and nails	12	13.0	1,450	11.0
		16	10.0	1,450	8.0
Coves and cornices	Wood lath and nails	12	14.0	1,450	22.0
		16	11.0	1,450	17.0
Wood furring	1- by 2-in. and 8d. nails 2ft. c:	12	4.6	930 L.F.	13.5
		16	3.5	705 L.F.	10.5
		20	2.7	540 L.F.	9.0
		24	2.4	480 L.F.	7.5
Metal corner beads	On masonry	..	.....	100 L.F.	4.0
Metal corner beads	On wood	..	.....	100 L.F.	2.0

the scratch and brown coats as a tie to hold the plaster together. Hair should be long cattle or goat hair, free from grease.

Lime.—Lime may be either lump (quicklime) or hydrated. Quicklime is a calcined material, the major part of which is calcium oxide or calcium and magnesium oxides, which will slake on the addition of water. Hydrated lime is a dry flocculent powder resulting from the mechanical slaking or hydration of fresh quicklime. Lime paste or putty is a material of workable consistency resulting from the slaking of quicklime or of a mixture of hydrated lime with water to a similar consistency. When made from quicklime it should be allowed to age under proper conditions.

Quicklime.—Quicklime is sold in barrels of 180 and 280 lb. net weight. When slaked it increases in bulk 2½ times more or less, depending on the grade of lime. A 180-lb. barrel will make from 6 to 7 cu. ft. of paste

Slaking of Lump Lime.[1]—Quicklime can never be used as such for structural purposes: It must always be slaked first. Since the method of slaking is an important factor in determining the quality of the finished product, the following directions are given:

Different kinds of lime vary considerably in the way in which they behave with water. A little supervision over the operation of slaking will amply pay for itself by insuring the production of the greatest possible quantity and the best possible quality of putty. To find out how to slake a new lot of lime, it is safest to try a little of it and see how it works. Since different lots of the same brand of lime vary somewhat, and since the weather conditions at the time have a decided influence, it is wise to try a sample from each lot used, whether familiar with the brand or not.

Classification.—In a bucket, put two or three lumps of lime about the size of one's fist, or, in the case of granular lime, an equivalent amount. Add enough water to just barely cover the lime, and note how long it takes for slaking to begin. Slaking has begun when pieces split off from the lumps or when the lumps crumble. Water of the same temperature shall be used in test and field practice.

If slaking begins in less than 5 min., the lime is quickslaking; from 5 to 30 min., medium slaking; over 30 min., slow slaking.

Directions for Slaking.—For quick slaking lime, always add the lime to the water, not the water to the lime. Have enough water at first to cover all the lime completely. Have a plentiful supply of water available for immediate use—a hose throwing a good stream, if possible. Watch the lime constantly. At the slightest appearance of escaping steam, hoe thoroughly and quickly, and add enough water to stop the steaming. Do not be afraid of using too much water with this kind of lime.

[1] National Lime Association, Bulletin 306.

For medium slaking lime, add the water to the lime. Add enough water so that the lime is about half submerged. Hoe occasionally if steam starts to escape. Add a little water now and then if necessary to prevent the putty from becoming dry and crumbly. Be careful not to add any more water than required, and not too much at a time.

For slow slaking lime, add enough water to the lime to moisten it thoroughly. Let it alone until the reaction has started. Cautiously add more water, a little at a time, taking care that the mass is not cooled by the fresh water. Do not hoe until the slaking is practically complete. If the weather is very cold, it is preferable to use hot water, but if this is not available, the mortar box may be covered in some way to keep the heat in.

White Coat.—After the action has ceased, run off the putty through a No. 8 sieve. Add sand up to equal parts by weight, all of the hair required, and store for a minimum of 2 wks.

Mason's Mortar.—After the action has ceased, add part or all of the sand required, and store for a minimum of 24 hr.

Hydrated Lime.—Hydrated lime is sold in standard 50-lb. packages. One cubic foot weighs about 40 lb., and it will make approximately 1 cu. ft. of fairly stiff paste equivalent to similar paste made from quicklime.

Plaster of Paris.—Plaster of Paris is made from gypsum, a rock which consists of calcium sulphate combined with water. When heated until three-fourths of the water is driven off, it is known as *calcined gypsum* or plaster of Paris.

Gypsum Plaster.—Gypsum plaster is calcined gypsum to which has been added from 10 to 15 per cent of hydrated lime and other retarding material, making the setting time vary from 1 to 6 hr. It is sold as neat plaster when the sand has to be added at the job, or as prepared plaster when the proper proportion of hydrated lime, retarder, sand and fiber are already included. In this state it has only to be wet up and mixed before being applied.

Keene's Cement.—Keene's cement is a calcined gypsum prepared under a special formula and will give a very hard, smooth surface when properly applied. It is used where a hard sanitary surface is required and is usually finished to imitate wall tile.

The best grades of pure calcined gypsum are shipped in paper-lined wooden barrels that hold from 250 to 320 lb. net. Neat gypsum plasters come in burlap bags containing 100 lb., or in paper bags of 80 lb. each. Ready mixed plasters are shipped in burlap bags of 100 lb.

Cement Plaster.—Cement plaster for interior work is used only for plastering masonry walls, and as a base or scratch coat to support

decorative wall tile and wainscoting. It is used principally for exterior stucco work. Wood lath should not be used when cement plaster is applied as a scratch coat, as metal lath makes a more satisfactory job. For cement data see "Concrete."

EXTERIOR FINISHING

In the *Integral* method the color aggregates are mixed with the sand and cement and applied as the finish coat of stucco. After the stucco has set about 2 hr. it is scrubbed with a brush and clean water or mopped with a sponge, taking care not to disturb the aggregates. This removes the cement film and exposes the full color value of the aggregate.

If a muriatic acid solution is used (1 part acid to 5 parts clean water) care must be taken not to wash away too much of the cement, and to spray the stucco immediately with water to remove all traces of the acid.

In the "cast on" method the color aggregates are thrown on the finish coat of white stucco while it is still fresh and lightly pressed in with the float.

Smooth Troweled.—The finishing coat is lightly smoothed with a metal trowel (not recommended).

Stippled.—After the finish coat has been lightly smoothed with a metal trowel, it is lightly and evenly "stippled" with a broom straw bush.

Sand Floated.—The finish coat is first smoothed and then rubbed with a wood float, using a circular motion and a little sand to roughen the surface slightly. This must be done within 30 min. after the application, otherwise the initial "set" will be disturbed.

Sand Sprayed.—The smooth surface is sprayed with a wide, long fiber brush or whisk broom dipped into a creamy mixture of equal parts of cement and sand mixed fresh every half hour, and kept constantly stirred. This coating is thrown forcibly on the moist surface before it has obtained its final set.

Spatter Dash or Rough Cast.—The finish coat is scratched, then a mixture of 1 part cement and 2 of sand is thrown forcibly on it to produce a rough surface of uniform texture. Care is necessary to prevent this finish from drying out too rapidly.

Pebble Dash.—Clean round pebbles, ¼ to ¾ in. in size, are thrown forcibly against the surface before the finish coat has attained its final "set."

Plastering

Material and Labor Required to Cover 100 Sq. Yd.

Wood Lath

Material	Grounds	3-coat work												2-coat work									
		Scratch coat 1–2 mix and brown coat 1–3 mix												1 coat of 1–2 mix or 1 coat of 1–3 mix									
		Material				Labor		Material				Labor		Material				Labor		Material				Labor	
		Binder	Sand	Hair	Plaster	Plasterer	Laborer	Binder	Sand	Hair	Plaster	Plasterer	Laborer	Binder	Sand	Hair	Plaster	Plasterer	Laborer	Binder	Sand	Hair	Plaster	Plasterer	Laborer
	In.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.
Quicklime	⅝													366	0.91	2.3	1.04			281	1.04	0.7	1.04		
	¾	246	0.61	1.5	0.70			140	0.52	0.4	0.52			430	1.06	2.7	1.22	8.2	6.6	329	1.22	0.8	1.22	8.2	6.6
	⅞	366	0.91	2.3	1.04	5.8	5.8	140	0.52	0.4	0.52	8.2	7.1	550	1.36	3.4	1.56			422	1.56	1.0	1.56		
	1	366	0.91	2.3	1.04			235	0.87	0.9	0.87			674	1.66	4.2	1.91			516	1.91	1.3	1.91		
Hydrated lime	⅝													489	0.91	2.3	1.04			374	1.04	0.7	1.04		
	¾	329	0.61	1.5	0.70			187	0.52	0.4	0.52			573	1.06	2.7	1.22	8.2	6.6	439	1.22	0.8	1.22	8.2	6.6
	⅞	489	0.91	2.3	1.04	5.8	5.8	187	0.52	0.4	0.52	8.2	7.1	733	1.36	3.4	1.56			562	1.56	1.0	1.56		
	1	489	0.91	2.3	1.04			313	0.87	0.9	0.87			898	1.66	4.2	1.91			688	1.91	1.3	1.91		

Neat gypsum	⅝																	966	0.74		1.04			899	1.04		1.04		
	¾	648	0.50		0.70	5.8	5.8	391	0.45		0.52	7.8	7.5	1,129	0.87		1.22	8.3	6.8	1,054	1.22		1.22	8.3	6.8
	⅞	966	0.74		1.04			391	0.45		0.52			1,444	1.11		1.56			1,348	1.56		1.56		
	1	966	0.74		1.04			654	0.76		0.87			1,768	1.36		1.91			1,650	1.91		1.91		
Sanded gypsum	⅝													2,888			1.04						1.04		
	¾	1,944			0.70	5.8	5.8	1,444			0.52	7.8	7.5	3,388			1.22	8.3	6.8				1.22	8.3	6.8
	⅞	2,888			1.04			1,444			0.52			4,332			1.56						1.56		
	1	2,888			1.04			2,416			0.87			5,304			1.91						1.91		
Keene's cement:																													
K.C.	⅝													369	0.92	1.2	1.04			277	1.04		1.04		
H.L.														246						108					
K.C.	¾	248	0.62	1.0	0.70			139	0.69		0.52			433	1.08	1.4	1.22			325	1.22		1.22		
H.L.		165						104						288				8.0	6.9	244				8.0	6.9
K.C.	⅞	369	0.92	1.2	1.04			139	0.69		0.52	8.8	7.0	553	1.38	1.8	1.56			416	1.56		1.56		
H.L.		246						104						369						312					
K.C.	1	369	0.92	1.2	1.04	6.1	6.1	232	0.87		0.87			677	1.69	2.3	1.91			509	1.91		1.91		
H.L.		236						174						451						382					

Material Data as used in Computations

Quicklime, 1 cu. ft.	= 65 lb.	Sand, 1 cu. ft.	= 96 lb.
Quicklime, 1 bu.	= 1.24 cu. ft.	Voids in sand	35 per cent
Hydrated lime, 1 cu. ft.	= 40 lb.	Cement, 1 cu. ft.	= 96 lb.
Gypsum, 1 cu. ft.	= 64 lb.	Keene's cement, 1 cu. ft.	= 64 lb.
Allowance made for waste and key		For finish coat—See Table 3.	

PLASTERING
MATERIAL AND LABOR REQUIRED TO COVER 100 SQ. YD.

Material	Grounds	Brick or tile 2-coat work: 1 coat of 1–2 mix or 1 coat of 1–3 mix						¼-in. plaster board 2-coat work: 1 coat of 1–2 mix or 1 coat of 1–3 mix					
		Material				Labor		Material				Labor	
		Binder	Sand	Hair	Plaster	Plasterer	Laborer	Binder	Sand	Hair	Plaster	Plasterer	Laborer
	In.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.
Quicklime.....	½	406	1.00	2.5	1.15			311	1.15	0.8	1.15		
	⅝	539	1.33	3.3	1.53			413	1.53	1.0	1.53		
	¾	674	1.66	4.2	1.91	9.5	7.7	501	1.19	1.2	1 91	9.5	7.7
	⅞	807	1.99	5.0	2.29			618	2.29	1.5	2.29		
Hydrated lime...	½	541	1.00	2.5	1.15			414	1.15	0.8	1.15		
	⅝	719	1.33	3.3	1.53			551	1.53	1.0	1.53		
	¾	898	1.66	4.2	1.91	9.5	7.7	688	1.91	1.2	1.91	9.5	7.7
	⅞	1,076	1.99	5.0	2.29			824	2.29	1.5	2.29		
Neat gypsum....	½	1,065	0.82	....	1.15			864	1.00	....	1.15		
	⅝	1,416	1.09	....	1.53			1,150	1 33	....	1.53		
	¾	1,768	1.36	....	1.91	9.6	7.8	1,435	1.66	....	1.91	9.6	7.8
	⅞	2,120	1.64	....	2.29			1,720	1.99	....	2.29		

Material	Grounds	¼-in. plaster board 2-coat work: 1 coat of 1–2 mix or 1 coat of 1–3 mix						Lath and plaster 3-coat work					
		Material				Labor		Material				Labor	
		Binder	Sand	Hair	Plaster	Plasterer	Laborer	Binder	Sand	Hair	Plaster	Plasterer	Laborer
	In.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.
Quicklime.....	½	268	0.66	1.7	0.76			296	0.76	0.5	0.76		
	⅝												
	¾	406	1.00	2.5	1.15	6.0	6.0	311	1.15	1.0	1 15	6.0	6.0
	⅞	490	1.21	3.0	1.39			375	1.39	1.2	1.39		
Hydrated lime...	½	357	0.66	1.7	0.76			274	0.76	0.5	0.76		
	⅝												
	¾	541	1.00	2.5	1.15	6.0	6.0	414	1.15	1.0	1.15	6.0	6.0
	⅞	653	1.21	3.0	1.39			500	1.39	1.2	1.39		
Neat gypsum....	½	704	0.54	....	0.76			511	0 66	....	0.76		
	⅝												
	¾	1,065	0.82	....	1.15	7.3	7.3	864	1.00		1.15	7.3	7.3
	⅞	1,287	0.99	...	1.39			1,044	1.21	....	1.39		

Sanded gypsum.	½	3,194	....	....	1.15			3,456	....	....	1.15			.....	....	....	....			.....	....	....	0.76		
	⅝	4,249	....	....	1.53			4,598	....	....	1.53			2,111	....	....	0.76			2,284	....	....	0.76		
	¾	5,304	....	....	1.91	9.6	7.8	5,740	....	....	1.91	9.6	7.8	3,194	....	....	1.15	7.3	7.3	3,456	....	....	1.15	7.3	7.3
	⅞	6,359	....	....	2.29			6,881	....	....	2.29			3,860	....	....	1.39			4,177	....	....	1.39		
Keene's cement:																									
K.C.	½	408	1.02	1.4	1.15			307	1.15	....	1.15														
H.L.		272						230																	
K.C.	⅝	542	1.36	1.8	1.53			408	1.53	..	1.53			269	0.67	0.9	0.76			203	0.76	....	0.76		
H.L.		362						306						179						152					
K.C.	¾	677	1.69	2.3	1.91	9.8	7.7	509	1.91	....	1.91	9.8	7.7	408	1.02	1.4	1.15	9.5	9.5	307	1.15	....	1.15	9.5	9.5
H.L.		451						382						272						230					
K.C.	⅞	812	2.03	2.7	2.29			611	2.29	...	2.29			493	1.23	1.6	1.39			371	1.39	....	1.39		
H.L.		541						458						329						278					
Portland cement 10 per cent lime:																									
H.L.—lb.	½	54	1.00	2.5	1.15			41	1.15	0.8	1.15														
P.C.—bbl.		3.17						2.43																	
H.L.—lb.	⅝	72	1.33	3.3	1.53			55	1.53	1.0	1.53			36	0.66	1.7	0.76			27	0.76	0.5	0.76		
P.C.—bbl.		4.21						3.23						2.09						1.60					
H.L.—lb	¾	90	1.66	4.2	1.91	13.8	9.7	69	1.91	1.2	1.91	13.8	9.7	54	1.00	2.5	1.15	13.8	11.3	41	1.15	1.0	1.15	13.8	13.8
P.C.—bbl.		5.25						4.03						3.17						2.43					
H.L.—lb.	⅞	108	1.99	5.0	2.29			82	2.29	1.5	2.29			65	1.21	3.0	1.39			50	1.39	1.2	1.39		
P.C.—bbl		6.30						4.83						3.80						2.93					

PLASTERING

MATERIAL AND LABOR REQUIRED TO COVER 100 SQ. YD.

Material	Grounds	Metal lath, 3-coat work, Scratch coat 1–2 mix and brown coat 1–3 mix: Material				Labor		Material				Labor	
		Binder	Sand	Hair	Plaster	Plasterer	Laborer	Binder	Sand	Hair	Plaster	Plasterer	Laborer
	In.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.	Lb.	C.Y.	Bu.	C.Y.	Hr.	Hr.
Quicklime	⅝	529	1.31	3.3	1.50			159	0.59	0.4	0.59		
	¾	529	1.31	3.3	1.50	6.5	6.8	257	0.95	0.6	0.95	9.1	8.0
	⅞	529	1.31	3.3	1.50			362	1.34	0.9	1.34		
Hydrated lime	⅝	705	1.31	3.3	1.50			212	0.59	0.4	0.59		
	¾	705	1.31	3.3	1.50	6.5	6.8	342	0.95	0.6	0.95	9.1	8.0
	⅞	705	1.31	3.3	1.50			482	1.34	0.9	1.34		
Neat gypsum	⅝	1,389	1.07	....	1.50			443	0.51	....	0.59		
	¾	1,389	1.07	....	1.50	6.8	6.8	714	0.83	....	0.95	9.4	8.3
	⅞	1,389	1.07	....	1.50			1,007	1.17	....	1.34		

Finish coat, estimated ⅛ in. thick except pebble dash ¼ in. thick: Material			Plaster, C.Y.	Plasterer, hr.	Laborer, hr.
Quicklime	225	Lb.	0.35	11.3	3.8
Plaster paris	150	Lb.			
Hydrated lime	285	Lb.	0.35	11.3	3.8
Plaster paris	150	Lb.			
Quicklime	170	Lb.	0.35	12.5	4.2
White sand	0.21	C.Y.			
Hydrated lime	227	Lb.	0.35	12.5	4.2
White sand	0.21	C.Y.			
Quicklime	208	Lb.	0.35	12.3	4.6
Plaster paris	100	Lb.			
Marble dust	100	Lb.			
Hydrated lime	277	Lb.	0.35	12.3	4.6
Plaster paris	100	Lb.			
Marble dust	100	Lb.			

Sanded gypsum	5/8	4,166	....	....	1.50			1,638	....	....	0.59				Portland cement (smooth finish)	0.93	Bbl.	0.35	17.8	4.9
	3/4	4,166	....	....	1.50	6.8	6.8	2,638	....	....	0.95	9.4	8.3		Sand	0.33	C.Y.			
	7/8	4,166	....	....	1.50			3,721	....	....	1.34									
															Portland cement (rough finish)	0.93	Bbl.	0.35	19.0	11.0
Keene's cement:															Sand	0.33	C.Y.			
K.C.	5/8	532	1.33	1.8	1.50			157	0.59	....	0.59									
H.L.		355						118							Hydrated lime	14	Lb.	0 35	17.7	4.5
K.C.	3/4	532	1.33	1.8	1.50	6.7	6 7	253	0 95		0.95	10.2	8.0		Portland cement	0 836	Bbl.			
H.L.		355						190							Sand	0.33	C.Y.			
K.C.	7/8	532	1.33	1.8	1.50			357	1.34	....	1.34									
H.L.		355						268												
															Portland cement (pebble dash)	2 18	Bbl.	0.70	26.7	17.8
															Sand	0.61	C.Y.			
Portland cement 10 per cent Lime:															Pebbles	0.14	C.Y.			
															Keene's cement (hard finish)	599	Lb.	0.35	16.3	4.9
H.L.—lb.	5/8	71	1.31	3.3	1.50			21	0 59	0.4	0.59									
P.C.—bbl.		4.13						1.25							Keene's cement (smooth finish)	440	Lb.	0.35	15.6	4.9
H.L.—lb.	3/4	71	1.31	3.3	1.50	9.0	7.5	34	0.95	0.6	0.95	13.8	9.7		Hydrated lime	100	Lb.			
P.C.—bbl.		4.13						2.01												
H.L.—lb.	7/8	71	1.31	3.3	1 50			48	1.34	0.9	1.34				Keene's cement (sand float)	125	Lb.			
P.C.—bbl		4.13						2.83							Hydrated lime	62	Lb.	0.35	16.0	4.5
															Sand	0.33	C.Y.			

Exposed Aggregates.—Marble or granite screenings, coarse sand or any other special aggregates desired are used for the finish coat in proper proportions. They can be treated either by washing as described under "integral method," or by the "cast on" method in the same manner as employed in the "pebble dash" treatment.

In estimating plaster work it is important to know what class or grade of work is required. Plastering may be divided into three classes, the principal difference in cost being in the amount of labor involved.

Class *A* work is the highest grade and requires expert mechanics as all surfaces must be screeded and rodded, trowelled to a plane surface, out of wind, with all corners plumb and square. This grade is usually required in the finest residences and in the best grade of buildings.

Class *B*, permitting variations up to ¼ in., is used in the average residential work and public buildings, and is not plumbed or rodded. The bulk of plaster work is of the Class *B* type and is sometimes applied as two-coat or drawn work, in which the brown coat is run over the scratch coat, before the latter is dry, using the same staging or scaffold. The labor hours as given in the following tables are based on this class of work:

Class *C*, the cheapest grade, used mainly in low priced residences and shops, consists of two coats only, the scratch coat being floated up to within 1/16 in. of the ground and a thin skim coat applied.

CHAPTER XIV

FIRE DOORS AND WINDOWS

STEEL SASH[1]

Fenestra Solid Steel Windows are made of low carbon open-hearth rolled steel. The Fenestra joint at the intersection of the vertical and horizontal muntin bars is of a special design that requires the

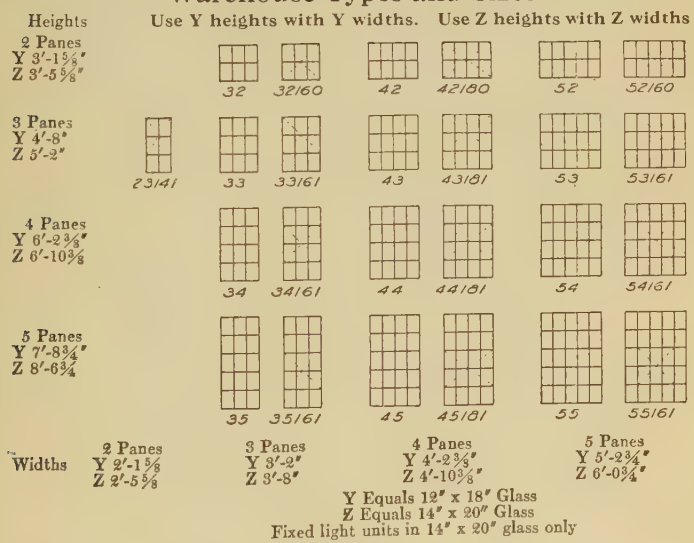


Fig. 1.

cutting away of less than 20 per cent of the metal at this point. The joint therefore instead of being the weakest point in the sash is as strong as any other portion of the sash and will withstand a pressure from the inside as great as that from the outside. The ventilators are horizontally pivoted 2 in. above the center and have double contact weathering around all sides.

[1] Courtesy Detroit Steel Products Company.

Steel sash in standard sizes are made up for the use of 12- by 18-in. or 14- by 20-in. glass. These sizes can be combined by the use of mullions to fit practically any sized opening required. Two inches must be allowed for the width of the mullion. Warehouse sizes and types are shown in the following illustration.

If possible, windows from the standard warehouse types shown above should be selected, as these are carried in stock. They can be used singly or in bays of two or more units, filling practically any sized opening. They accommodate 12- by 18-in. and 14- by 20-in. glass, which sizes of glass are designated by the letters *Y* and *Z*. The dotted cross-lines indicate ventilators.

The modern type of factory construction makes practically essential the use of solid steel windows. Among their advantages are their fireproof qualities and the amount of natural light which they admit due not only to their large size but also to the fact that steel windows of the same size as wood or hollow metal admit at least 20 per cent more daylight. Steel windows can be installed in a building at practically the same price and in a great many instances at a lower price than wooden windows. By their use any amount of ventilation can be provided.

Prices.—Sidewall types of sash vary in price from 20 to 40 cts. per square foot depending upon the percentage of ventilation required and the size of the units. Small units cost more per square foot than large units. The erection of steel windows costs about 7 cts. per square foot. Steel sash are painted in the shop with one coat of red oxide paint. They must be given a second coat in the field, either before or after erection. A field coat of paint before the sash are glazed will cost about 3½ cts. per square foot. Steel sash cannot be shipped ready glazed. The glazing must be done after the sash are erected. Steel sash putty must be used for this work. Putty costs about 4 cts. per square foot and glazing labor about 5 cts. per square foot. One-eighth-inch factory ribbed glass costs between 12 and 15 cts. per square foot. One-quarter-inch rough wire glass costs approximately 11 cts. per square foot more.

In determining weights of steel sash and glass 5½ lb. are allowed for steel sash glazed with ⅛-in. glass and 7¼ lb. glazed with ¼ -in. glass.

Reversible Ventilator Type Sash.—The reversible ventilator type sash is used principally for schools, institutions, banks, lofts, and office buildings. The ventilators are made in two types, one opening

in and the other out. When opening outward, the lower part of the ventilator swings out and the upper portion slides down in a straight line, no portion projecting inside of the building so that ordinary shades may be used. For the ventilator opening inward, the upper part of the ventilator swings in, and the lower portion slides up in a straight line, thus allowing no portion of the ventilator to project outside the line of the sash. Ventilators of this type are usually used at the sill, and when open only 4 or 5 in., take the place of a wind baffle to deflect the wind upward. They should not be made more than 18 in. high, nor more than 40 in. wide. Ventilators opening outward can be used either for the top or bottom of the sash and can be made 32 in. high and 40 in. wide. These are maximum sizes and it is recommended that the smaller sizes be used.

Sash and frames are all self-contained and a special unequal leg channel is used around the outside so that the plaster can be carried directly to the windows, thus eliminating the use of all trim. These windows are also equipped with continuous glazing angles for holding the glass in place. The price of this window erected in place with continuous glazing angle but exclusive of glazing runs about $1 per square foot. The weight per square foot of this window is approximately the same as that for the sidewall window. Windows can be furnished without continuous glazing angles, which would reduce the price about 20 cts. per square foot.

Fenestra Continuous Type Sash.—Fenestra Continuous Type Sash made up of tees, angles and a special shaped sill member are recommended for sawtooth roof construction, where the sash are placed off the vertical, also for monitor roof construction where a continuous opening with no breaks is desired. On account of the large-sized lights necessary and due to the fact that no horizontal muntins are used, ¼-in. wire glass is required for this type of sash, and glazing is done from the outside. Where ventilators are installed, the swinging portion is made in long runs and a tension type mechanical operating device must be used. The sash are made in standard heights of 3, 4, 5 and 6 ft., and when set in steel framing requiring clear opening dimensions between steel 1½ in. less than the sash dimensions. The lengths can be made for any dimensions but it is desirable that these be kept in even feet.

The cost of continuous-type sash, either fixed or ventilated, will average about 25 cts. per square foot, and the erection will cost from

6 to 8 cts. per square foot. If ventilated sash is required, to this price must be added the cost of the mechanical operating device which will average about $1.60 per running foot in place.

The usual method is to operate the sash in lengths of 100 ft. Operating chains can be carried to the floor to any desired location by means of idlers. The sash are made in 20-ft. lengths and spliced together in the field in such a manner as to make a continuous sash for the 100-ft. length if ventilated, or for the entire opening, if fixed.

Counterbalanced Fenestra Windows.—Counterbalanced Fenestra Windows are of the vertically sliding type, with the lower sash balancing the upper sash so that no counter weights are used. The frame is made up of 4-in. channels for the side members, and special pressed sections of a design to make sash weather proof for the top and bottom members. Heavy steel sash chains and roller bearing pulleys are used in connection with this type of window. Fifty per cent ventilation is produced, of which one-half occurs at the top of the opening and the other half at the bottom.

A rough price for counterbalanced sash erected is about $1 per square foot on a fair-sized job. This may, however, vary considerably according to the size of the job and the number of different types of sash required.

Underwriters Fenestra Sash.—Underwriters Fenestra Sash, bearing underwriters labels, are made up in the side-wall type and counterbalanced type. The Underwriters Specifications require that no sash must be greater than 7 ft. in one direction or 12 ft. in the other direction, but that multiples of these sash can be used connected together by T-bar mullions. This allows unlimited width of openings. Continuous glazing angles are used in this type of sash. This sash must be glazed with ¼-in. wire glass.

The price of this sash is 20 to 25 cts. per square foot greater than that for standard sash.

FIRE DOORS

There is a large variety of fire doors, such as tin-clad, hollow metal, metal-covered, rolling steel, corrugated steel, asbestos, etc. No attempt has been made to cover the entire field but only to give the data that will cover the varieties in common use.

Tin-clad Doors.—Tin-clad fire doors are perhaps used more than any other type. This has probably been brought about not because

of their superiority, but rather because of the ease of their construction. They are made by concerns in almost every city of any size, and can even be made by contractors at the job. The doors are either 2- or 3-ply. The 2-ply are $1\frac{3}{4}$ in. thick, and the 3-ply $2\frac{1}{2}$ in. thick. They are constructed of dressed and matched sheathing laid diagonally, each ply crossing at right angles to the ply next to it, and are then covered with heavy grade first quality tin.

Requirements of the Fire Underwriters.—The following quotations from the "Regulations of the National Board of Fire Underwriters" give considerable useful data regarding tin clad doors:

Tin-clad Fire Doors.—Standard tin-clad fire doors are fairly substantial in construction, practical under most conditions, and easy to install. Doors on both sides of the wall furnish a high degree of resistance to fire and to the transmission of heat for long periods of exposure, and resist fire streams well. Under adverse conditions of service they are liable to deteriorate rapidly and are difficult to maintain.

Sliding Doors.—Size and shape of doors. Doors shall be designed for openings not exceeding 120 sq. ft. Doors shall overlap sides and top of wall opening 4 in. Top of door shall conform to incline of track, $\frac{3}{4}$ in. to 1 ft.

Mounting Sliding Doors.—Mounting track. Length of track must be equal to twice the width of the wall opening plus 21 in.

Wall bolts shall be so spaced that one bolt will be located directly opposite each hanger when the door is closed, and so that front and back bumpers can be attached. Holes shall be $\frac{13}{16}$ in. in diameter.

NOTE.—Doors for opening in excess of 6 ft. in width require three hangers. Track shall have an incline of $\frac{3}{4}$ in. to 1 ft. when mounted.

Price of Tin-clad Doors.—These doors can be made at the job, but it is usually more economical to buy them from one of the many companies whose doors have been accepted by the Board of Fire Underwriters and which carry the underwriters label. The Coburn Trolley Track Manufacturing Company quotes the following prices which represent a fair average: 2-ply 65 cts. per square foot, and 3-ply 75 cts. per square foot, f.o.b. Holyoke, Mass. To this must be added the cost of hardware and erection.

Time Required for Erection.—The time required to hang an ordinary fire door on a brick wall is from 6 to 8 hr. for a man and a helper.

M. E. Almetl Fire Doors.—These doors are made of corrugated iron and asbestos by the Merchant and Evans Company, Philadelphia, and

are used in the same class of buildings as the tin-clad doors. They are made of the following types: Single sliding, double sliding, vertical sliding, single and double swing, and carry the underwriters label.

Description of Door Construction.—This door has a panel of transversely laid standard 2½-in. corrugated galvanized heavy-gage steel, with an interlining of asbestos, all being securely held in a

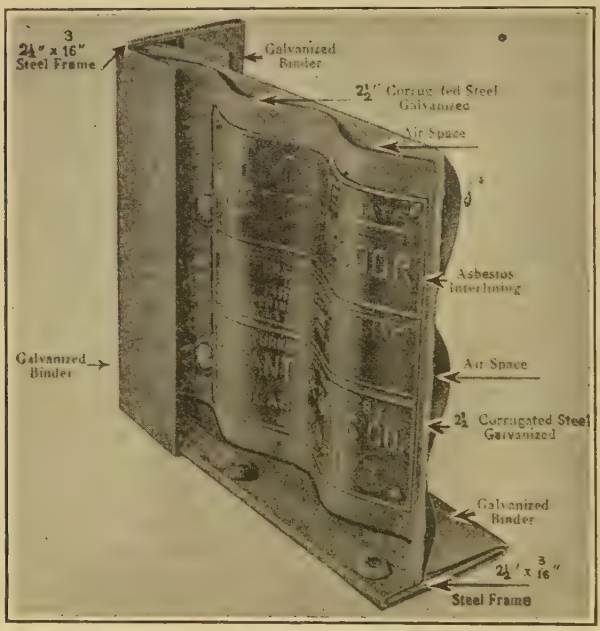


FIG. 2.—"Almetl" fire door.

continuous frame of 2½- by 3/16-in. bar steel. All joints are welded and riveted, not bolted. The frame and ends of panel sheets are protected by a cover binder of heavy galvanized sheet steel, securely riveted to the frame, thus forming an armor to protect the edges of the door from abuse. In riveting the panel sheets to the frame, due provision is allowed for expansion and contraction without excessive distortion. The cross-laid corrugated panel sheets give maximum strength with minimum weight. The large air passages between the corrugations of the panel sheets and the asbestos interlining provide the greatest possible resistance to the radiation of heat. (See Fig. 2.)

Cost.—The cost will vary somewhat with the size of the opening, also with current price for material, but at the present time the average price is 70 cts. per square foot f.o.b. factory.

Time to Install.—The amount of labor to install these doors will vary with the thickness of the wall and the kind of masonry, as well as with the size of the door. It requires more time to install a door on a 20-in. wall than on a 12-in. wall, and the labor is somewhat greater for setting on stone masonry than for brick. Assuming average conditions for a 5- by 8-ft. door in a 12-in. wall, it will take a mechanic and a helper 8 hr. per door.

Hardware.—The present cost of hardware for these doors of improved Underwriters type is about as follows:

5 by 8 ft. in a 12-in. wall, single sliding	$20
5 by 8 ft. in a 12-in. wall, double sliding	35
5 by 8 ft. in a 12-in. wall, single swing	20
5 by 8 ft. in a 12-in. wall, double swing	38

These prices are f.o.b. point of shipment.

Rolling Steel Doors.—In line with the present-day tendency towards fire prevention, there is being manufactured a complete line of rolling steel and fireproof air chamber doors, both of which have been tested and approved by the Underwriters' Laboratories, Inc.

Rolling steel doors are equipped with baffle plates in the hood and "fire-stops" on the edges of the slats that prevent smoke and flame from passing through the opening.

Where required, the doors are equipped with an automatic device, which at a temperature of approximately 160 deg. causes the doors to close by fusing one of two links, located at the head or side of the opening and near the ceiling. On fusing the link, the shaft is given sufficient impetus to force the curtain down which closes easily on the sill and can be raised without difficulty, allowing passage through the opening in an emergency. The automatic device can easily be reset and a new link inserted without removing the hood or dismantling the door. Where occasion requires, a governor to control the speed of the curtain can be furnished.

For the protection of window openings a special automatic device is employed. This device is held in position by a chain passing through the wall to the interior, the shutter being on the exterior.

The chain is hooked at a convenient point inside and can be released instantly by unhooking the chain, which closes it independently of the action of the automatic device. This affords immediate protection against fire in an adjoining building. The shutter can be tested in the same manner and easily reset by hooking the chain and raising the shutter. In case of fire the fusing of a link on the outside of the building will close the shutter. The bottom bars of the curtains, as well as the grooves, are provided with slotted holes and fusible washers allowing for expansion due to heat, and preventing buckling of door to grooves. The bottom of the groove is placed ¾ in. above the sill for the same purpose.

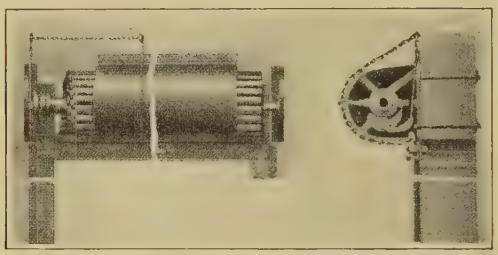


Fig. 3.—Rolling steel fire door.

The coils and grooves may be placed on the face of the wall, giving clear width and height, or recessed below the lintel and in the jambs according to requirements. Operation can be either by handle on the bottom bar or by chain and crank gearing. Doors too large to bear the underwriters' label may be furnished with a certificate of approval from the Underwriters' Inspector.

Underwriters' limitations are as follows:

Vertical shafts, corridors and room partitions: Where the area does not exceed 80 sq. ft., neither the width nor the height of the curtain shall exceed 12 ft. Curtains may be hung on the face of the wall or between jambs and be operated manually or mechanically. Fire-wall openings: The same regulations apply to these as to openings in vertical shafts, corridors, and room partitions except that two doors are required.

Openings in exterior walls: The area of the opening is not to exceed 100 sq. ft. and the width or the height not to exceed 12 ft. Curtains may be hung on the face of the wall or between jambs and operated

manually or mechanically. Where desired they may close automatically in case of fire.

These doors may be obtained from the following:

The Cornell Iron Works	New York, N. Y.
Geo. W. Johnson Manufacturing Company	Kansas City, Mo.
Kinnear Manufacturing Company	Columbus, Ohio
Variety Fire Door Company	Chicago, Ill.
J. G. Wilson Corporation	Norfolk, Va.

The approximate average price per square foot for this type of door, 8 ft. wide by 10 ft. high is $3.50 f.o.b. factory. The freight, cartage and erection would figure approximately 50 cts. per square foot in addition.

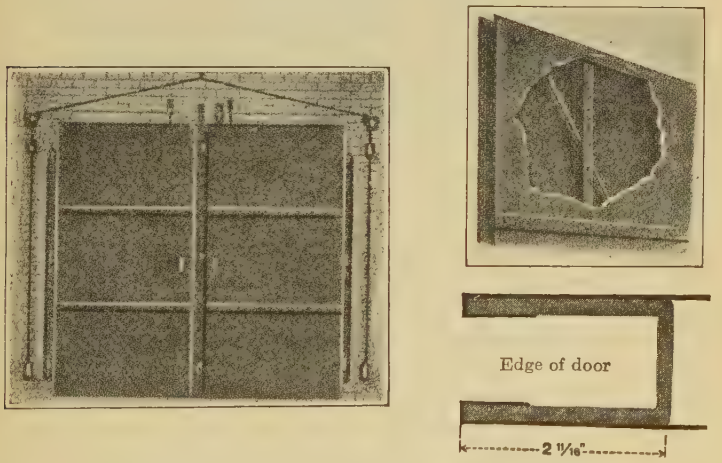


FIG. 4.—Fireproof air chamber doors, showing construction.

Fireproof Air Chamber Door.—The Fireproof air chamber door is practical and durable, rigid in construction and capable of withstanding hard usage. As it is covered with galvanized sheet steel, it is not affected by corrosion. It is simple and easy to operate and presents an excellent appearance, the cover sheets being plain and not corrugated.

The door frame is composed of 3- by 1⅝-in. channel, 3/16 in. thick, and is acetylene welded at the corners, forming a continuous channel

frame. This frame is covered with 24-gage, continuous galvanized sheet steel on both sides. The web of the door is reinforced by special channels running vertically, spaced 12 in. apart and the cover sheets are secured to these channels by rivets or bolts. The cover sheets themselves are lapped around the outstanding legs of the channel frame and secured to the channel by means of electro spot-welds every 6 in. around the outer periphery. The top and bottom members of the channel frame are ventilated by means of $\frac{3}{8}$-in. holes through the web of the channel. This provides a circulation of air through the chambers formed in the door. These doors are made in single and double swinging types, as well as in a sliding type with either horizontal or sloping track. All types are equipped with an automatic closing device, including fusible links and weights.

Underwriters' limitations are as follows:

Single swinging type for interior openings must not exceed 6 ft. in width and 12 ft. in height; for exterior opening, 4 ft. in width and 12 ft. in height. Double swinging type for interior openings must not exceed 10 ft. in width and 12 ft. in height; for exterior openings, 6 ft. in width and 12 ft. in height. Sliding type for interior openings must not exceed 120 sq. ft. in area, neither width nor height to exceed 12 ft.

Cost of Doors.—The average price for this type of door 8 ft. wide by 10 ft. high would be $1.25 per square foot, f.o.b. factory. Freight, cartage and erection add approximately 50 cts. per square foot.

Horizontal Folding Doors.—For driveway openings and those on loading platforms, etc. and where the question of light is a factor, horizontal folding doors are readily adaptable. This type of door is divided horizontally into an upper and a lower section hinged together and a weather-tight joint provided where the sections meet. The door frames are formed of T-irons braced by angles forming panels. The panels in the lower section are usually filled with standard interlocking slats, similar to those used in rolling steel doors, and the upper section can be treated similarly or with standard units of steel sash. An added convenient feature is a small wicket door in the lower section, which makes entrance and exit possible without raising the entire door.

These doors are operated in a similar manner to rolling steel doors; that is to say, by a spring counterbalanced shaft and endless chain

and gearing. No weights are required. When placed on the exterior of the building the door, when raised, forms a canopy over the opening, an obvious advantage in inclement weather. There are certain localities which tax permanent canopies over sidewalks, but

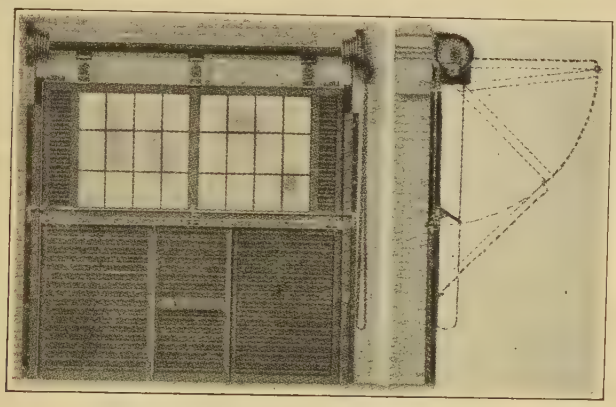


FIG. 5.—Horizontal folding doors.

as this door is a canopy by day only, being closed at night, it would not be affected by such a tax. Unusually large doors may be operated by electric motor.

The average price per square foot for this type of door would be $2.50, f.o.b. factory. Freight, cartage and erection 50 cts. per square foot in addition.

CHAPTER XV

ROOFING

Computing Areas.—The area of a roof is estimated by scaling the width along the slope and multiplying it by the length of the roof including the overhang. When the roof has to be figured from a plan, the level or plan area of the roof is multiplied by the factor for the rise in inches per foot. The result will be the actual or slant roof area for any type of roof including hips, gables and dormers. Where there is an overhang over the main roof as on dormer roofs, this will have to be added.

FACTORS FOR OBTAINING ROOF AREAS

Rise	Factor	Rise	Factor	Rise	Factor
3	1.031	6	1.118	9½	1.275
3½	1.042	6½	1.137	10	1.302
4	1.054	7	1.158	10½	1.329
4½	1.068	7½	1.179	11	1.357
5	1.083	8	1.202	11½	1.385
5½	1.100	8½	1.250	12	1.414
		9	1.250		

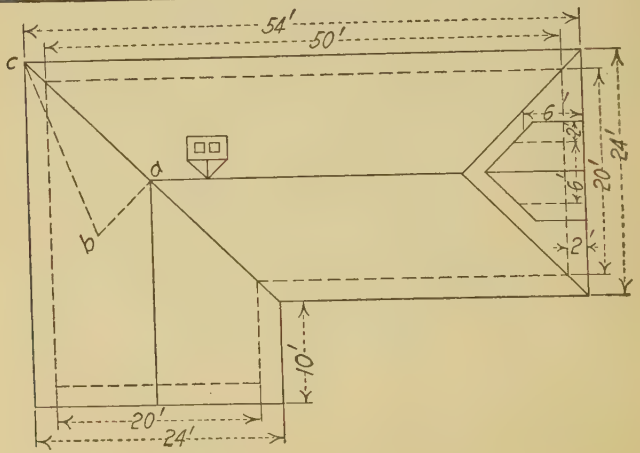


FIG. 1.—Plan of roof.

Example: With a rise of 6 in. per foot and a roof as per sketch, then:

	Square Feet
Plan area = 54 by 24 ft. + 10 by 24 ft. =	1,536
Dormer overhang = 2 by 6 ft. + 2 by 6 ft. × 2 =	36
Total plan area =	1,572
Factor for 6-in. rise	1.118
Roof area =	1,757.496

Roof pitches are sometimes given as two-thirds, one-half, etc., which denotes ratio of the total rise in feet to the total span of the roof in feet, *viz.*: two-thirds means a rise of 13 ft 4 in. in a span of 20 ft. The equivalent rise per foot for the various ratios is as follows:

Two-thirds pitch = 16-in. rise per foot
One-half pitch = 12-in. rise per foot
One-third pitch = 8-in. rise per foot
One-fourth pitch = 6-in. rise per foot.

APPROXIMATE WEIGHT OF ROOFING MATERIAL

Roofing Material	Weight per Square Foot, Pounds
Copper, No. 22 B. W. G.	1¼
Corrugated galvanized iron, No. 20 B. W. G.	2¼
Corrugated galvanized iron, No. 26 B. W. G.	1¼
Felt, 2 layers	½
Felt and asphalt or coal-tar	2
Glass, ⅛ in. thick	1¾
Lath and plaster ceiling	6–8
Lead, ⅛ in. thick	7½
Mackite, 1 in. thick, with plaster	10
Sheathing, hemlock, 1 in. thick	2
Sheathing, white pine, spruce, 1 in. thick	2¼ -2½
Sheathing, yellow pine, 1 in. thick	3½
Shingles, 6 by 18 in., 5½ in. to weather	2
Skylight, glass 3/16 to ½ in. including frame	4–10
Slag roof, 4-ply, with cement and gravel	4
Slate, ⅛ in. thick, 3-in. double lap	4½
Slate, 3/16 in. thick, 3-in. double lap	6¾
Terneplate, IC.	⅝
Terneplate, IX	½
Tiles (plain), 10½ by 6¼ by ⅝ in., 5¼ in. to weather	18
Tiles (Spanish), 14½ by 10½ in., 7¼ in. to weather	18½
Zinc, No. 20 B. W. G.	1½

JOHNS-MANSVILLE ASBESTOS SHINGLES

Catalogue number of shingles	Size, inches	Thickness, inch	Weight per 100 shingles, pounds	Weight per square applied, pounds	Number shingles per square	Surface exposed, inches	Galvanized nails per square, pounds	Number of storm anchors required per square	Number of sections, ridge roll required per 100 lineal feet (3-in. lap)	Catalogue number of starter	Number of starters required per 100 lineal feet	Method of laying
3	12 by 12	⅛	215	515	240	5 by 12	2½	...	93	51 (¼ in.)	67	American
4[1]	12 by 12	⅛	205	495	240	5 by 12	2½	...	93	51 (¼ in.)	67	American
5	8 by 16	⅛	185	480	260	7 by 8	2½	...	93	51 (¼ in.)	67	American
6[1]	8 by 16	⅛	175	455	260	7 by 8	2½	...	93	51 (¼ in.)	67	American
9	16 by 16	⅛	345	300	87	13 by 13	1	87	93	17 (¼ in.)	75	Diagonal
										11 (⅜ in.)	67	
12	12 by 12	⅛	200	320	160	9½ by 9½	1½	160	93	17 (¼ in.)	75	Diagonal
										14 (⅜ in.)	89	
50	9 by 18	¼	320	650	204	8 by 9	2	...	93	51 (¼ in.)	67	American
60	12 by 12	⅛	200	320	160	9½ by 9½	1½	160	93	17 (¼ in.)	75	Hexagonal
										61 (⅜ in.)	77	
70	16 by 16	⅛	345	300	87	13 by 13	1	87	93	17 (¼ in.)	75	Hexagonal
										71 (⅜ in.)	58	

[1] Clipped corners.

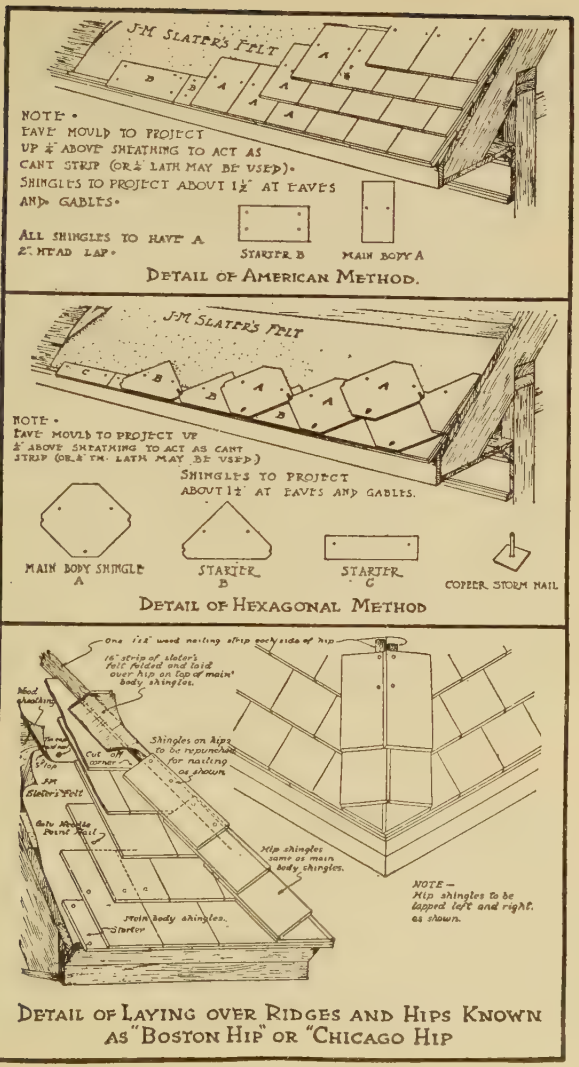

J-M SLATER'S FELT
A
B
NOTE.
EAVE MOULD TO PROJECT UP ¼" ABOVE SHEATHING TO ACT AS CANT STRIP (OR ¼" LATH MAY BE USED).
SHINGLES TO PROJECT ABOUT 1½" AT EAVES AND GABLES.
ALL SHINGLES TO HAVE A 2" HEAD LAP.
STARTER B
MAIN BODY A
DETAIL OF AMERICAN METHOD.
J-M SLATER'S FELT
NOTE.
EAVE MOULD TO PROJECT UP ¼" ABOVE SHEATHING TO ACT AS CANT STRIP (OR ¼" LATH MAY BE USED)
SHINGLES TO PROJECT ABOUT 1½" AT EAVES AND GABLES.
MAIN BODY SHINGLE A
STARTER B
STARTER C
COPPER STORM NAIL
DETAIL OF HEXAGONAL METHOD
One 1"x2" wood nailing strip each side of hip
16" strip of slater's felt folded and laid over hip on top of main body shingles.
Wood sheathing
Cut off corner
Shingles on hips to be repunched for nailing as shown
J-M Slater's Felt
Hip shingles same as main body shingles.
NOTE — Hip shingles to be lapped left and right, as shown.
Main body shingles.
Starter
DETAIL OF LAYING OVER RIDGES AND HIPS KNOWN AS "BOSTON HIP" OR "CHICAGO HIP

FIG. 2.

Method of Laying.—By the American method the shingles are laid square similar to wood shingles. By the diagonal method shingles are laid diagonally. The hexagonal is similar to the diagonal except that the corners of the square shingles have been clipped.

Labor.—The time required to lay 1 square of Asbestos shingles is from 4 to 5 hr.

CLASSIFICATION OF SLATE SHINGLES

Pennsylvania Slates

Genuine Bangor is the best quality of Pennsylvania slate and is dark or blue-grey. It is sold only with a certificate of the Bangor Slate Association and each slate is labeled to prevent substitution.

No. 1 Clear has a uniform surface, a thickness of $\frac{3}{16}$ in. and straight clear corners with no ribbons. Its weight is 650 lb. per square. The cost f.o.b. quarry is $8.10 to $12.60 depending on size.

Medium Clear but not of No. 1 grade costs $7.30 to $8.50.

No. 1 Ribbon is similar to No. 1 Clear with a limited amount of ribbons not visible when laid and costs $7.30 to $8.50.

No. 2 Ribbon is the same as No. 1 Ribbon with ribbons visible when laid. The cost is $5.25.

Albion, a blue-grey or blue-black slate is not quite as good as Bangor in No. 1, Medium, and No. 2 grades.

Vermont Slates

The gradings for Vermont slate are same as for Pennsylvania slate.

Unfading Green weathers slightly darker.

Weathering Green weathers to buff brown and yellow. The degree in change of color is variable.

Clear Purple may be dark purple or grey and is similar to unfading green.

Mottled Purple is the same as above with green markings.

Red is found in various shades and grades.

SLATE SHINGLES PER 100 SQ. FT.

Shingles			Nails or wire required, pounds					
			3d		4d			
Size	No.	Weather	Copper or galvanized	Tinned	Copper or galvanized	Tinned	Aluminum wire	Plain wire
24 by 14	98	10½	1.20	....	1.60	1.20	0.60	1.40
24 by 12	115	10½	1.50	1.20	1.10	1.50	0.70	1.70
22 by 12	126	9½	1.70	1.40	1.12	1.70	0.80	1.90
22 by 11	138	9½	1.90	1.50	1.15	1.90	0.90	1.11
20 by 12	142	8½	1.10	1.60	2.00	1.10	0.90	1.12
20 by 10	170	8½	1.15	1.11	2.60	1.15	0.10	2.20
18 by 12	160	7½	1.13	1.90	2.40	1.13	0.10	2.00
18 by 10	192	7½	2.30	1.14	2.11	2.30	0.11	2.60
18 by 9	214	7½	2.70	2.10	3.80	2.70	0.12	2.11
16 by 12	185	6½	2.20	1.12	2.90	2.20	0.11	2.50
16 by 10	222	6½	2.80	2.20	3.10	2.80	0.12	2.12
16 by 9	247	6½	2.13	2.60	3.50	2.12	0.13	3.10
16 by 8	277	6½	3.20	2.11	3.14	3.20	0.15	3.80
14 by 10	261	5½	3.00	2.80	3.10	3.00	0.14	3.40
14 by 8	327	5½	3.12	3.20	4.90	3.12	1.20	4.20
14 by 7	374	5½	4.40	3.10	5.30	4.40	1.40	4.11
12 by 8	400	4½	4.90	3.14	5.90	4.90	1.60	5.00
12 by 7	457	4½	5.30	4.60	6.60	5.30	1.90	5.11
12 by 6	533	4½	6.10	5.20	7.60	6.10	1.13	6.11

Labor.—A slater and a helper will lay one square of average sized slate in plain work in 2.8 hr.

Tile Roofs.—Clay tile for roofs is made in various styles such as French, Spanish, English, Closed Shingle, etc. The price varies according to the style, size and color and should be obtained from the manufacturer or dealer. The present average price is $20 per square for red Spanish unglazed tile delivered. The various common glazed tile ranges from $20 to $35 per square. The labor required to lay one square of tile including the felt is 5 hr. This is the average for a building of about 35 by 65 ft. including dormer, ridge, hips, etc. The weight per square for tile only is 800 to 1,200 lb.

Tin Roofing.—Tin roofings consist of iron or steel plates covered with tin or with a mixture of lead and tin. The former is called "bright tin" and the latter "terne plates." There are three methods of laying tin roofing—batten, standing seam, and flat seam, the standing and flat seam being more common. The standing seam requires less labor to lay than either of the other two methods. In the flat seam type the sheets are locked into each other at the edges, fastened with cleats, flattened and soldered. This method is used on flat roofs or where the pitch is less than one-third. The standing seam is used on steep roofs, the cross seams being locked and soldered, the vertical seams (from eaves to ridge) interlocked and nailed or cleated but not soldered. All tin roofing should be painted on the underside and laid on two layers of tar paper.

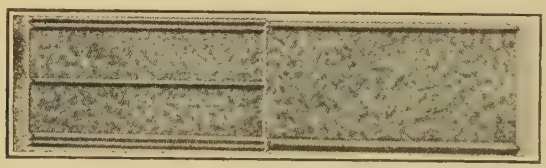


Fig. 3.—V-crimped roofing.

The common sizes of roofing tin are 10 by 14 in., 14 by 20 in. and 20 by 28 in. They are usually packed 112 sheets in a box. The present cost per box for size 20 by 28 in. for the various coatings is as follows: 8 lb. \$14, 12 lb. \$15.75, 15 lb. \$17.25, 20 lb. \$18.25 and 40 lb. \$26.

V-crimped Roofing.—When the pitch of the roof is 3 in. to the foot or more, corrugated and V-crimped roofing or metal shingles may be used. If V-crimped roofing is desired, the extra V in the 3 V-crimped roofing strengthens the sheet and prevents rattling. Where the roof pitch is less than 3 in. to the foot, roll and cap, or pressed standing seam roofing should be used as slow running water or melting snow cannot seep through the joints in these styles. V-crimp roofing is used extensively on account of its ease of application. It is made with 2, 3 and 5 crimps. V-shaped wood sticks are used under the overlapping crimps. Fifty lineal feet of strips are required per square. It is not necessary to put sticks under the intermediate crimps when the multiple crimp type is used. All styles have a covering width of 24 in. and the sheets are from 5 to 10 ft. long. They are made of 24-, 26-, 28- and 29-gage metal.

The present price for 28-gage V-crimped roofing including sticks is as follows: 2-crimp, with sticks, averages $4.50 for painted and $5.50 for galvanized, per square; for 3-crimp $4.70 and $5.80; for 5-crimp $4.80 and $5.90; for pressed standing seam roofing painted $4.50, and for galvanized $5.60.

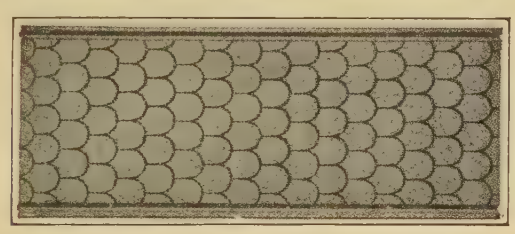


FIG. 4.—Cluster shingles.

Cluster Shingles.—Cluster shingles are made in sheets from 5 to 10 ft. long with an interlocking crimp on both sides. The price per square for these shingles when made of 28-gauge painted steel is $5.70 and for galvanized steel $6.90.

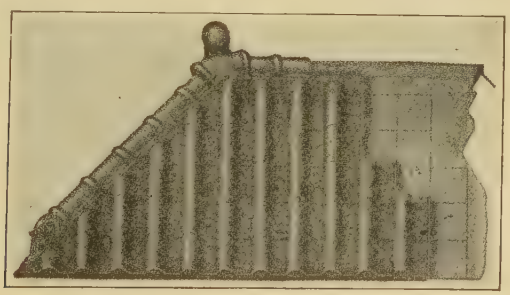


FIG. 5.—Metal roofing tile and fixtures.

Metal Tile.—Metal tiles are made to imitate clay tiles. They are stamped from plain or galvanized sheet steel and from sheet copper. The cost per square of field and cave tiles made of painted steel is $10, and of galvanized steel $12.50. Sidewall flashing and gable starter tiles, painted or galvanized, cost 15 cts. per lineal foot; ridge or hip finish, including flashing, 35 cts. per lineal foot; finals, $3 each.

Metal Shingles.—Pressed metal shingles of galvanized Toncan metal, of galvanized open hearth or of steel or painted terne plate are used where a fireproof roof with shingle effect is required. These shingles are made in various sizes and styles. A fair average price is $6.50 per square delivered.

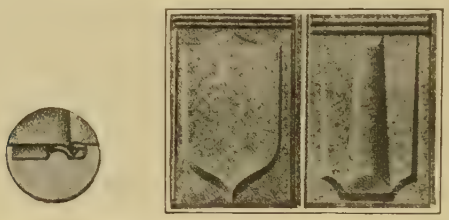


FIG. 6.—Metal shingles showing type of side lock.

Zinc Tile.—Zinc tile is made in No. 9 zinc gage, which is approximately No. 27 U. S. standard gage. Under favorable conditions zinc, like copper, will last indefinitely, and does not require painting. The first cost, which is somewhat less than copper and slightly more than galvanized iron, is the only cost as there is practically no maintenance required. To avoid electrolysis zinc must not come in contact with

FIG. 7.—Pressed brick siding.

other metals, especially with steel. Field and cave tiles cost $18 per square; sidewall flashing and gable starters 20 cts. per lineal foot; ridge and hip finish, including flashing, 60 cts. per lineal foot; finials, $5 each. These prices are f.o.b. destination.

Pressed Metal Siding.—Pressed metal siding in imitation of weatherboarding, brick or stone is made in sheets 60 by 28 in. The present average price is as follows: Weatherboard, painted $4.70,

galvanized $5.80; brick, painted $4.32, galvanized $5.42; rock faced brick and stone, $4.42 and $5.51 per square.

Corrugated Roofing and Siding.—The cost of corrugated roofing and siding based on 28-gage metal is as follows: For 2½-in. corrugated steel, painted $4.25, galvanized $5.30; 1½-in. corrugations $4.40 and $5.50 per square f.o.b. destination.

FIG. 8.—Plain ridge roll.

MISCELLANEOUS ROOF FITTINGS

Ridge roll, valley, flashing or hip capping	$1.24 per 10 ft. length
Corrugated ridge roll, side or end wall flashing	1.05 per 10 ft. length
Plain round ridge roll and V capping	0.90 per 10 ft. length
Formed valley, 20 in.	1.43 per 10 ft. length
Gable finial	2.50 per 10 ft. length
Hip starter	0.75 per 10 ft. length
Galvanized roofing nails, 1 by 1¾ in.	0.12 per pound
Lead washers	0.25 per pound

ROOF FITTINGS—GALVANIZED STEEL

SINGLE BEAD LAP JOINT EAVES TROUGHS

(Price and weights per 100 lineal feet)

Size, in.	3		4		5		6	
Girth, in.	6		8		10		12	
Gage	List	Lb.	List	Lb.	List	Lb.	List	Lb.
29	$13	35	$16	46	$19	58	$23	70
28	15	38	18	50	21	63	25	76
26	19	44	22	58	25	73	30	88
24	..	..	28	75	31	93	37	112

LEADERS—GALVANIZED

(Price and weights per 100 lineal feet, round, plain and corrugated)

Gage	2 in.		3 in.		4 in.		5 in.		6 in.	
	List	Lb.	List	Lb.	List	Lb.	List	Lb.	List	Lb.
29	$13	47	$15	58	$20	76	$25	94	$30	111
28	15	51	17	63	23	82	28	102	33	121
26	19	59	21	74	28	96	34	119	40	141
			27	95	35	123	44	152	52	180

SQUARE CORRUGATED

Gage	1¾ by 2¼ in.		2⅜ by 3¼ in.		2¾ by 4¼ in.		3¾ by 5 in.	
	List	Lb.	List	Lb.	List	Lb.	List	Lb.
29	$15	46	$17	60	$22	80	$27	99
28	17	50	19	65	25	87	30	107
26	21	59	23	76	30	101	36	125
..	..	..	29	98	37	130	46	160

ELBOWS AND SHOES—GALVANIZED STEEL NO. 29 GAGE

	2 in.	3 in.	4 in.	5 in.	6 in.
Round, plain and corrugated	$0.30	$0.36	$0.60	$1.25	$1.50
Round shoes	0.40	0.48	0.75	1.50	1.80
Square, corrugated	0.40	0.50	0.65	1.00	
Square shoes	0.50	0.60	0.80	1.25	

The prices given are list prices. Net prices delivered are about 75 per cent off for gutters, 70 per cent off for leaders and 60 per cent off for elbows.

Copper Leaders

		2 in.	3 in.	4 in.	5 in.	6 in.
Round	14-oz.	$0.27	$0.33	$0.47	$0.63	$0.80
	16-oz.	0.30	0.36	0.51	0.69	0.90
Square	14-oz.	0.28	0.37	0.49	0.65	
	16-oz.	0.31	0.40	0.53	0.75	

Discount 32½ per cent.

Copper Gutters

(Half round)

		3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.
Single bead lap joint	14-oz.	$0.23	$0.28	$0.33	$0.39	$0.49	$0.56	$0.72	$0.85
	16-oz.	0.26	0.32	0.36	0.44	0.54	0.63	0.80	0.95
Single bead slip joint	14-oz.	0.26	0.31	0.36	0.42	0.52	0.59	0.75	0.88
	16-oz.	0.29	0.35	0.39	0.47	0.57	0.66	0.83	0.98
Double bead lap joint	14-oz.	0.28	0.37	0.40	0.50	0.57	0.67	0.84	0.97
	16-oz.	0.32	0.40	0.45	0.55	0.64	0.75	0.92	1.07
Double bead slip joint	14-oz.	0.31	0.40	0.43	0.53	0.60	0.70	0.87	1.00
	16-oz.	0.35	0.43	0.48	0.58	0.67	0.78	0.95	1.10

Discount 32½ per cent.

Copper Elbows and Shoes

Round

(Plain or corrugated)

Size, in.	14-oz.		16-oz.	
	Elbows	Shoes	Elbows	Shoes
2	$0.70	$0.75	$0.75	$0.85
2½ and 3	0.90	1.00	1.00	1.10
3½ and 4	1.35	1.50	1.50	1.65
5	2.00	2.25	2.25	2.50
6	2.85	3.15	3.15	3.50

Discount 25 per cent.

SQUARE
(Corrugated)

Size, in.	14-oz.		16-oz.	
	Elbows	Shoes	Elbows	Shoes
2	$0.85	$0.90	$0.90	$1.05
3	1.10	1.20	1.20	1.35
4	1.60	1.80	1.80	2.00
5	2.40	2.75	2.75	3.00

Discount 25 per cent.

SINGLE BEAD COPPER GUTTER MITRES

Size, in.	14-oz.		16-oz.	
	Lap joint	Slip joint	Lap joint	Slip joint
3	$0.75	$0.85	$0.85	$0.95
3½	0.80	0.90	0.90	1.00
4	0.85	0.95	0.95	1.05
4½	0.90	1.00	1.00	1.10
5	0.90	1.00	1.00	1.10
6	0.95	1.05	1.05	1.15
7	1.00	1.15	1.15	1.30
8	1.20	1.35	1.35	1.50

Discount 25 per cent.

COPPER GUTTER END PIECES, CAPS AND OUTLETS

Size, in.....	3	3½	4	4½	5	6	7	8
Ends with outlet.....	$0.95	$1.00	$1.05	$1.10	$1.10	$1.15	$1.30	$1.50
End caps only.....	0.40	0.45	0.45	0.48	0.48	0.50	0.60	0.70
Outlets only.....	0.40	0.45	0.45	0.48	0.48	0.50	0.60	0.70

No discount.

Copper Wire Leader Strainers

Size, in.	Round, stubs galvanized wire	Price per dozen	Size, in.	Square, stubs galvanized wire	Price per dozen
2	No. 17	$1.80	2 by 3	No. 17	$ 4.00
3	No. 17	2.90	3 by 4	No. 16	8.00
4	No. 16	4.20	4 by 4	No. 16	9.00
5	No. 16	7.20	5 by 4	No. 15	10.00
6	No. 15	8.25	4 by 5		

Discount 15 per cent.

Painted Corrugated Sheets

(Weights in pounds per 100 sq. ft.)

Corrugated, in.	Thickness, United States standard gage														
	10	12	14	16	18	20	21	22	23	24	25	26	27	28	29
5	...	470	336	269	215	162	148	135	122	108	95	81	75	68	
3	...	472	338	270	216	163	149	136	122	109	95	82	75	68	
2½	615	478	342	274	219	165	151	137	124	110	97	83	76	69	
2½	607	472	338	270	216	163	149	136	122	109	95	82	75	68	
2	...	...	...	270	216	163	149	136	122	109	95	82	75	68	
1¼	...	...	...	...	...	169	155	141	127	113	99	85	78	71	
⅞	...	...	...	...	...	...	...	...	...	113	99	85	78	71	

Galvanized Corrugated Sheets

(Weights in pounds per 100 sq. ft.)

Corrugated, in.	Thickness, United States standard gage														
	10	12	14	16	18	20	21	22	23	24	25	26	27	28	29
5	...	486	352	285	231	178	164	151	137	124	111	97	90	84	77
3	...	488	353	286	232	178	165	151	138	125	111	98	91	84	77
2½	631	494	358	290	235	181	167	153	140	126	113	99	92	85	78
2½	623	488	353	286	232	178	165	151	138	125	111	98	91	84	77
2	...	...	...	286	232	178	165	151	138	125	111	98	91	84	77
1¼	...	...	...	...	...	186	172	158	144	130	116	102	95	88	81
⅞	...	...	...	...	...	...	...	...	...	130	116	102	95	88	81

LABOR TO INSTALL

Sheet Metal Work

Kind of material and gage	On wood or steel	Weight of sheets per square foot in pounds	Weight of 100 sq. ft. of finished work in pounds	Hours required to lay one square with man and helper
Plain steel No. 28		0.638	70.18	3.2
Black iron No. 28		0.625	68.75	3.2
Plain galvanized: Steel No. 28	On wood	0.798	87.78	3.2
Plain galvanized: Steel No. 26	On wood	0.925	101.75	3.2
Plain galvanized: Steel No. 24	On wood	1.180	129.80	3.2
Plain galvanized: Steel No. 20	On wood	1.690	185.90	4.0
Plain galvanized: Iron No. 28	On wood	0.785	86.35	3.2
Plain galvanized: Iron No. 26	On wood	0.910	100.10	3.2
Plain galvanized: Iron No. 24	On wood	1.160	127.60	3.2
Plain galvanized: Iron No. 22	On wood	1.410	155.10	3.6
Plain galvanized: Iron No. 20	On wood	1.660	182.60	4.0
2½-in. corrugated galvanized: Steel No. 28	On wood	0.870	102.06	3.2
2½-in. corrugated galvanized: Steel No. 26	On wood	1.009	118.37	3.2
2½-in. corrugated galvanized: Steel No. 24	On wood	1.287	150.98	3.2
2½-in. corrugated galvanized: Steel No. 20	On wood	1.893	216.20	4.0
2½-in. corrugated galvanized: Steel No. 28	Steel	0.870	102.06	4.0
2½-in. corrugated galvanized: Steel No. 26	Steel	1.009	118.37	4.0
2½-in. corrugated galvanized: Steel No. 24	Steel	1.287	150.98	4.0
2½-in. corrugated galvanized: Steel No. 20	Steel	1.843	216.20	4.6

Kind of material	Unit	Weight in pounds per unit of finished work	Hours to perform one unit of shop labor with man and helper	Hours to perform one unit of field labor with man and helper
16-oz. copper: Batten seam roof	100 sq. ft.	110	1.7	3.2
16-oz. copper: Standing seam roof	100 sq. ft.	110	1.7	2.5
16-oz. copper: Flat seam roof	100 sq. ft.	105	2.3	3.6
16-oz. copper: Wall covering	100 sq. ft.	105	1.1	4.0
16-oz. copper: Plain casings	100 sq. ft.	105	1.1	5.3
16-oz. copper: 20-in. flashings	100 lin. ft.	175	2.0	4.0
16-oz. copper: 36-in. box gutter linings	100 lin. ft.	315	6.9	24.0
16-oz. copper: Mouldings 24-in. girt	100 lin. ft.	210	6.9	8.0
16-oz. copper: Mouldings 30-in. girt	100 lin. ft.	262	8.6	10.7
16-oz. copper: Mouldings 36-in. girt	100 lin. ft.	315	10.3	10.7
16-oz. copper: Mouldings 42-in. girt	100 lin. ft.	368	12.0	16.0
16-oz. copper: Mouldings 48-in. girt	100 lin. ft.	420	13.7	16.0
16-oz. copper: Leaders 4 by 5 in	100 lin. ft.	166	5.7	8.0
16-oz. copper: Leaders 4 by 4 in	100 lin. ft.	150	5.7	8.0
16-oz. copper: Leaders 3 by 4 in	100 lin. ft.	125	5.7	8.0
16-oz. copper: Leaders 2½ by 3 in	100 lin. ft.	100	5.7	8.0
16-oz. copper: Leader heads	1 each	5	2.3	1.6

1¼-in. corrugated	Galvanized steel No. 28	Wood	0.895	104.99	3.2
	Galvanized steel No. 26		1.037	121.65	3.2
	Galvanized steel No. 24		1.323	155.20	3.2
	Galvanized steel No. 28	Steel	0.895	104.99	4.0
	Galvanized steel No. 26		1.037	121.65	4.0
	Galvanized steel No. 24		1.323	155.20	4.0
2½-in. corrugated galvanized	Iron No. 26	Wood	0.992	116.36	3.2
	Iron No. 24		1.265	148.40	3.2
	Iron No. 22		1.538	180.42	4.0
	Iron No. 20		1.810	212.33	4.0
	Iron No. 26	Steel	0.992	116.37	4.6
	Iron No. 24		1.265	148.40	4.6
	Iron No. 22		1.538	180.42	5.3
	Iron No. 20		1.810	212.33	5.3
1¼-in. corrugated	Galvanized iron No. 28	Wood	0.880	103.23	3.2
	Galvanized iron No. 26		1.020	119.66	3.2
	Galvanized iron No. 24		1.300	152.50	3.2
	Galvanized iron No. 28	Steel	0.880	103.23	4.0
	Galvanized iron No. 26		1.020	119.66	4.0
	Galvanized iron No. 24		1.300	152.50	4.0

Tin	IC 40 lb. tin				
	Batten seam roof	100 sq. ft.	70	1.7	3.2
	Standing seam roof	100 sq. ft.	70	1.7	2.5
	Flat seam roof	100 sq. ft.	68	2.3	3.6
	36-in. box gutter linings	100 lin. ft.	204	6.9	24.0
	20-in. flashings	100 lin. ft.	113	2.0	4.0
Galvanized iron	No. 22 galvanized iron	100			
	Mouldings 24-in. girt	100	296	6.9	8.0
	Mouldings 30-in. girt	100	370	8.6	10.7
	Mouldings 36-in. girt	100	444	10.3	10.7
	Mouldings 42-in. girt	100	518	12.0	16.0
	Mouldings 48-in. girt	100	592	13.7	16.0
	Plain casings	Square	148	1.1	5.3
	Leader heads	1 each	5	2.3	1.6
	No. 26 galvanized iron				
	Leaders 4 by 5 or 6 in. dia	100 lin. ft.	152	5.7	8.0
	Leaders 4 by 4 or 5 in. dia	100 lin. ft.	137	5.7	8.0
	Leaders 3 by 4 or 4 in. dia	100 lin. ft.	114	5.7	8.0
	Leaders $2\frac{1}{2}$ by 3 or 3 in. dia	100 lin. ft.	91	5.7	8.0

Corrugated Sheets

(American Sheet and Tin Plate Company)

Description of sheets						Length of sheet, in.	Areas of sheets					
							Sq. ft. in 1 sheet			Sheets in 100 sq. ft.		
Corrugations				Width, in.			Corrugations			Corrugations		
Width, in.		Depth, in.	Number per sheet	Full sheet	Covering		5 in.	3 in., 2½ in., 2 in.	1¼ in., 5/8 in.	5 in.	3 in., 2½ in., 2 in.	1¼ in., 5/8 in.
Nominal	Actual											
5	5	7/8	6	28	25	60	11.67	10.83	10.42	8.57	9.23	9.60
3	3	1 9/16	9	26	24	72	14.00	13.00	12.50	7.14	7.69	8.00
2½	2⅔	½	10½	27½	24	84	16.33	15.17	14 58	6.12	6.59	6.86
2½	2⅔	½	10	26	24	96	18.67	17.33	16.67	5.36	5.77	6.00
2	2	7/16	13	26	24	108	21.00	19.50	18.75	4.76	5.13	5.33
1¼	1¼	3/8	20	25	23¾	120	23.33	21.67	20 83	4.29	4.62	4.80
5/8	5/8	3/16	40	25	24⅜	144	28.00	26.00	25 00	3.57	3.85	4.00

Standard lengths 5, 6, 7, 8, 9 and 10 ft. maximum length, 12 ft. except for 5/8-in. corrugation.
Sizes denoted 2½ are for the 27½ in. width.

The weights per 100 sq. ft. given in preceding tables do not include allowances for end or side laps. The following table gives the approximate number of square feet of sheeting necessary to cover an area of 100 sq. ft. and is based on sheets of standard width, 95 in. long. If longer or shorter sheets are used, the number of square feet required will vary accordingly.

SQUARE FEET OF 2½-IN. STANDARD CORRUGATED SHEETS TO COVER AREA OF 100 SQ. FT.

Side lap	End lap, in.					
	1	2	3	4	5	6
1 Corrugation	109	111	112	113	114	116
1½ Corrugation	116	117	118	120	121	122
2 Corrugation	123	124	126	127	129	130

Built-up Roofing.—Built-up roofing on wood sheathing is usually laid over a layer of dry roofing paper or felt to prevent the asphalt or tar from leaking through the boards. This dry layer is not included in the number of plies of roofing specified, a 5-ply roof meaning 5 plies of felt laid in tar or pitch in addition to the dry layer. The latter is not necessary when the roof deck is of concrete or of similar construction.

Built up roofing usually consists of 3, 4, or 5 plies of tarred felt laid in hot tar or pitch mopped on, and generally is finished by having gravel, slag or tile embedded in the final coat of pitch.

BUILT-UP ROOFING, MATERIALS AND LABOR PER SQUARE

Felt 500-ft. rolls	Gallons pitch		Pounds		Labor, hours
	On concrete	On wood	Gravel	Slag	
3 ply 0.75	17.5	13.4	400	300	1.6
4 ply 1.00	21.0	16.5	400	300	1.9
5 ply 1.25	24.0	20.0	400	300	2.1
5 ply 1.25	24.0	20.0	Tile 6 by 9 by 1 in.		8.0

Roofing paper and felt is put up in rolls containing 100, 200 or 500 sq. ft. and is sold by the roll or by weight. Pitch is sold by weight. The weight of a gallon of pitch is 10 lb. Gravel and slag are generally shipped in bags, the slag weighing 45 lb. and the gravel 65 lb. per bag. Promenade tiles, 6 by 9 by 1 in., weigh about 4½ lb. each and 266 tiles are required to cover a square.

Present-day prices for built-up roofs in place in the Metropolitan District, are 7 cts. per square foot for 3-ply gravel or slag, 8½ cts. for 4-ply, 10 cts. for 5-ply, and 45 cts. for 5-ply with tile. Five-ply Barret roof with a bond will average 15 cts. and with tile 50 cts. per square foot. These prices are for roofing when union labor costs $9.50 per day for the foreman, $8.50 for helpers, $14 for tile layers and $9.50 for tile layer's helpers.

The following quotations are from the Johns-Manville Company (effective July, 1923), f.o.b. factory:

		Per Square
Flexstone Asbestos Roofing, red, green and blue-black, in rolls		$3.75
Flexstone Asbestos Strip Shingles, red, green and blue-black		6.80
Flexstone Asbestos Individual Shingles, red, green and blue-black		7.85
Flexstone Asbestos Roofing, heavy (smooth surface, in rolls)		6.45
Flexstone Asbestos Roofing, extra heavy (smooth surface in sheets)		8.70
Flexstone Double-coated Asbestos Roofing (in rolls)		3.75
White Top Asbestos Roofing, heavy (in rolls)		6.45
White Top Asbestos Roofing, extra heavy (in sheets)		8.70
Regal (rag felt) Roofing	light	1.85
	medium	2.35
	heavy	2.90
Pilot (rag felt) Roofing	light	1.55
	medium	1.85
	heavy	2.20
Asphalt Roofing (rag felt, sand-surfaced)	light	1.20
	medium	1.55
	heavy	1.85
Skatekote (rag felt roll roofing, slate surfaced), red, green and blue-black		2.35

Standard Asbestos Built-up Roofing, approximately $13 per square laid, depending on location, nature of work, etc.

Asbestos Rigid Shingles

No. 5, 8 by 16 in., American method, gray	$16.75
No. 5, 8 by 16 in., American method, colored	22.90
No. 60, 12 by 12 in., Hexagonal method, gray	12.45
No. 60, 12 by 12 in., Hexagonal method, colored	16.00
No. 9, 16 by 16 in., Hexagonal method, gray	11.15
No. 9, 16 by 16 in., Hexagonal method, colored	15.25
No. 50, 9 by 18 in., American method, gray	18.20
No. 50, 9 by 18 in., American method, colored	26.50

The above prices on rigid shingles are for main body shingles and do not include starter courses or ridge roll.

Transite Corrugated Asbestos Roofing and Siding in sheets 42 in. wide by 4, 5, 6, 7 and 8 ft. long, ¼ in. thick . . . . 18 cts. per square foot.

Ready Roofing and Shingles.—Ready roofings consisting of a felt, base saturated with an asphaltic compound are furnished in rolls including sufficient nails and cement for applying. They are made with white, black, or gray felt surface and also furnished with an ornamental finish of crushed red or green slate, gravel, or crushed feldspar rock. A roll of ready roofing contains approximately 108 sq. ft. and will cover 100 sq. ft. of roof including laps. The plain roofing may be had in "2-square" rolls of 216 sq. ft. The quality of the felt base is the main item in governing the life of the ready roofing. The majority of felts are the so-called "rag felts" containing more or less wool, depending on the quality. Some felt bases are also made of asbestos fiber, which resists fire better than the common felts.

Plain roofing weighs from 35 to 60 lb. per square depending on the grade, and slate surfaced roofing about 80 lb. The time required to lay 1 square is 1 hr.

Flexible shingles of the same material as the roll roofing are made in individual shingles about 8 by 12 in., or in strips of 2 or 4 shingles, 12 by 20 in. and 10 by 32 in., these sizes varying slightly with the different makes. The former weigh about 225 lb. per square and require 6 lb. of 1-in. large head galvanized roofing nails. The strip shingles weigh about 190 lb. per square and require 4 lb. of nails.

The time required to lay 1 square of individual shingles is 3.2 hr. and for strip shingles 2.7 hr.

SKYLIGHTS

Price of Puttyless Skylights.—Flat or sawtooth type skylights containing 500 sq. ft. or more, glass area per skylight, erected $1 per square foot. Double pitch or hipped type skylights containing 500 sq. ft. or more, glass area per skylight, erected $1.20 per square foot.

For flat and sawtooth skylights containing less than 500 sq. ft. the price is from $1.40 to $1.50 per square foot, while for the double pitch and hipped types, the price is $1.70 to $1.80 per square foot. These prices cover standard puttyless skylight constructions such as the "Anti-Pluvius" as manufactured by the G. Drouvé Co., which have all metal parts exposed to the weather of galvanized iron. If these parts are of copper, the price should be increased about 15 cts. per square foot.

The better grades of puttyless skylights have a structural steel frame. The skylight ribs, or main supporting bars, are of structural steel and in consequence these types of skylights will in most cases take a span from ridge to eave of at least 8 ft. without intermediate support. Accordingly, if the span from ridge to eave does not exceed 8 ft., it is not necessary to include any additional structural steel for its support.

The G. Drouvé Company placed on the market a short while ago a skylight known as their "Anti-Pluvius" *non-corrosive* construction. In this type all metal parts exposed to the interior of the building are of brass and all metal parts exposed to the weather are of copper. This type of skylight should be figured at $2 per square foot glass area in flat or sawtooth types, and $2.25 per square foot glass area in double pitch or hipped types. This includes glass and erection.

Wire Screens for Skylights.—The area of wire screens used for skylights is generally from 4 to 6 in. larger in each direction than the skylight itself, and when the screens are placed on the same pitch as the skylights, the area should be figured on the slope and for the full size of the screen. The present cost of such screens when made of No. 12 gage galvanized wire with 1-in. diamond or square mesh, and having a frame of $\frac{3}{8}$-in. rod or channel, is approximately 70 cts. per square foot. Screens of the same type as described above with copper wire will cost $1 per square foot erected.

Weight of Skylights.—The approximate weight of structural steel puttyless skylights packed and ready for shipment is 4 lb. per square foot of skylight. The weight of ¼-in. wire glass boxed ready for shipment is approximately 4 lb. per square foot, while the weight of the skylight erected in place is 7 lb. per square foot.

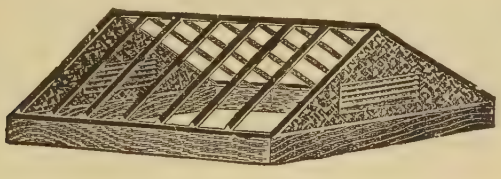


FIG. 9.—Double pitch

Sash Operating Devices.—The cost of sash operating devices of the worm and gear torsion type is about 80 cts. per lineal foot. The cost to be added for the erection of this type of gear is 30 cts. per lineal foot.

The cost of the tension type operators suitable for use on long runs of center pivoted or top hung sash is approximately $1 per lineal

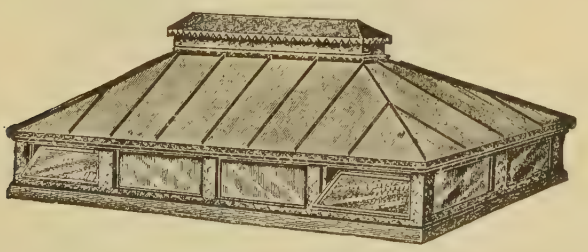


FIG. 10.—Hipped turret with ridge ventilator and movable sash.

foot. The cost of erecting this type is about 40 cts. per lineal foot. The prices named above are for jobs of reasonable size, but for small installations the price would be somewhat more.

Sheet Metal Work.—A plain double pitched skylight in ordinary sizes, complete, averages about 90 cts. per square foot of opening. This includes ¼-in. ribbed wire glass (Fig. 9).

A hipped skylight, complete, averages about $1.25 per square foot of opening, with an extra charge of $5 for the ventilating ridge and $1.50 per square foot for ventilating side sash. These sashes are about 2 ft. high (Fig. 10).

VENTILATORS[1]

More attention is constantly being given to the proper and adequate ventilation of factories, public buildings, residences, etc. The cost of ventilators is but a small item when compared with the cost of a building but adds to the health and comfort of those using it a great deal throughout its entire life.

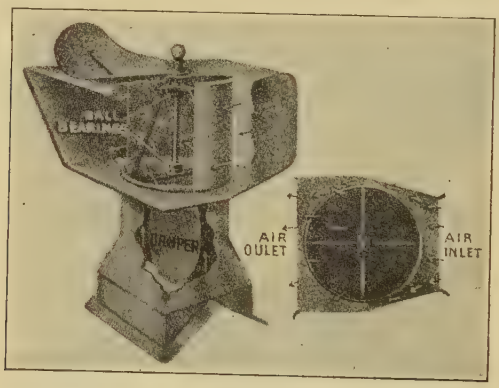


FIG. 11.—Revolving ventilator.

Burt Ball Bearing Revolving Ventilators.—These are equipped with two sets of ball bearings accurately machined and seated, so that they do not stick or bind. Dampers for this type of ventilator are placed in the base so as not to retard the free revolving motion of the ventilator itself. When bases of the Burt construction are used, the damper is furnished free of cost. If so specified, these dampers can be constructed in the fire-retarding type at a very slight additional cost. An extra charge is made for base. The fire-retarding type insures automatic closing in case of fire.

[1] Courtesy Burt Manufacturing Company.

PRICES, WEIGHTS AND GAGE OF IRON OF BURT BALL-BEARING REVOLVING VENTILATOR

Diameter of neck, in.	Price without damper	Gauge of iron	Net weight without crate	Gross weight crated
8	$ 12.00	22	18	30
10	14.00	22	20	35
12	16.00	22	30	50
14	24.00	22	35	65
16	30.00	22	42	75
18	38.00	20	50	100
20	46.00	20	60	125
24	54.00	20	90	160
30	76.00	18	140	220
36	114.00	18	190	310
40	150.00	18	250	350
42	162.00	18	280	470
48	180.00	18	390	650
54	210.00	18	575	750
60	250.00	16	650	980

F.o.b. Akron, Ohio, U. S. A.
Cone damper ventilators are equipped with fusible link to close damper in case of fire.

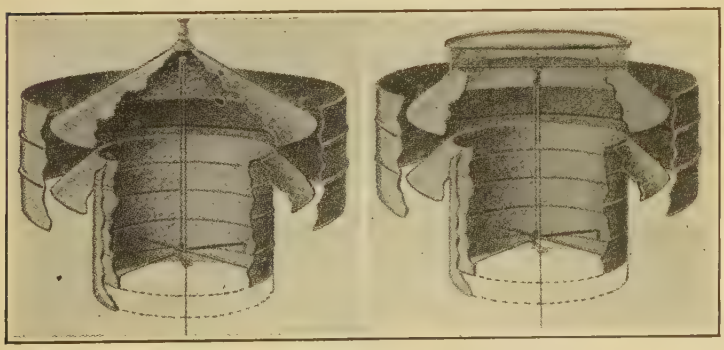


FIG. 12.—Glass and metal top ventilators.

Burt Sliding Sleeve Damper Ventilator.—This is made with either a metal or a glass top. When made with a glass top this ventilator is a combination skylight and ventilator, the light always passing through it is 100 per cent regardless of the position of the sliding sleeve damper, whether open or closed. When daylight is not a factor, this ventilator is made with a metal top, the only change being in the construction of the top.

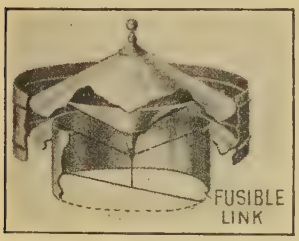


FIG. 13.—Sliding cone damper ventilator.

Burt Sliding Cone Damper Ventilator.—Primarily designed to meet the requirements of the Insurance companies and underwriters association. It is equipped with a sliding cone damper, fusible link, and patented raising and lowering device. The damper can be held in any position, thus regulating the ventilation to the exact amount required. This ventilator can be furnished with or without the fusible link as desired.

DISCOUNTS FOR THE BURT SLIDING SLEEVE DAMPER AND ROTARY BALL BEARING VENTILATORS

PER CENT	
30	Glass tops up to and including 48 in. with dampers
35	Glass tops up to and including 48 in. without dampers
20	Glass tops above 48 in. with dampers
25	Glass tops above 48 in. without dampers
40	Metal tops up to and including 24 in. with dampers
45	Metal tops up to and including 24 in. without dampers
30	Metal tops from 24 in. up to and including 48 in. with dampers
35	Metal tops from 24 in. up to and including 48 in. without dampers
20	Metal tops above 48 in. with dampers
25	Metal tops above 48 in. without dampers

F.o.b. cars Akron, Ohio.

Discounts on Burt Ball Bearing Revolving Ventilators are the same as those given above for Metal Tops with dampers. These discounts of course must be applied against the list prices as given for Revolving Ventilators. Cone Damper Ventilators take 15 points less than those listed above for Metal Tops with dampers. Burt Square Ventilators take the same discount as above. However, 25 per cent must be

added to list prices of the ventilators before applying the above discounts for the type of square ventilators desired. They can be made with either glass or metal top and with or without dampers.

PRICE LIST OF ROUND AND SQUARE BASES
(F.o.b. cars Akron, Ohio)

Strictly net	Round	Square
12-in. base	$ 2.00	$ 3.00
14-in. base	2.80	4.20
16-in. base	3.60	5.40
18-in. base	4.40	6.60
20-in. base	5.40	8.00
24-in. base	6.00	9.00
30-in. base	8.00	12.00
36-in. base	10.00	16.20
40-in. base	15.00	22.50
42-in. base	16.00	24.00
48-in. base	18.00	27.00
54-in. base	21.60	32.40
60-in. base	30.00	45.00
66-in. base	33.60	50.40
72-in. base	40.00	60.00

In ordering bases it is necessary to state whether round or square are required, and to send a sketch showing the pitch of the roof and the location of the ventilators whether for the ridge or the slope.

When glass top ventilators are ordered the use of square bases is recommended as the rays of light are thrown farther into the building and these bases give the ventilators more efficiency.

Bases made from Toncan Metal or Ingot Iron cost 10 per cent in advance of the above prices.

KERNCHEN VENTILATORS[1]

The following table gives the list prices f.o.b. car, South Gary, Indiana. At the present time they are subject to a discount of 20 per cent.

[1] Courtesy Kernchen Co.

There are many varieties of ventilators manufactured. Some may be cheaper than those given above of the Burt and the Kernchen, but these are reliable and as reasonable in price as other first-class makes.

FIG. 14.

K. S. V. Price List

Size, in.	Area, square inches	Exhaust per hour, cubic feet 10-mile wind velocity	Approximate shipping weight, pounds	Gage	Galvanized		Ingot iron, toncan, keystone or equivalent		Copper					
									Light			Medium		
					Dampers	Ventilators	Dampers	Ventilators	Ounce	Dampers	Ventilators	Ounce	Dampers	Ventilators
6	28	7,878	10	26	$ 2.55	$ 10.67	$ 2.81	$ 11.74	12	$ 3.08	$ 14.39	16	$ 3.23	$ 16.56
8	50	14,070	16	26	3.14	12.98	3.45	14.28	12	3.20	19.96	16	3.36	22.14
10	78	21,900	20	24	3.89	17.16	4.28	18.88	14	4.84	24.66	18	5.08	26.85
12	113	31,500	28	24	4.67	18.04	5.15	19.84	14	5.79	30.91	18	6.07	33.30
14	154	43,020	47	24	5.35	21.56	5.89	23.72	16	6.49	44.40	20	6.81	48.45
16	201	56,280	58	24	5.92	25.08	6.51	27.59	16	7.24	53.42	20	7.61	58.61
18	255	71,160	82	24	6.46	28.60	7.11	31.46	16	8.97	62.60	20	9.42	69.23
20	314	87,600	108	22	7.51	36.08	8.26	39.69	16	10.19	69.22	20	10.70	76.50
22	380	106,080	123	22	8.15	42.68	8.96	46.95	16	10.85	92.16	20	11.22	96.54
24	453	126,180	155	22	9.17	47.96	10.09	52.76	16	12.55	99.07	20	13.18	109.48
26	521	148,740	190	22	10.35	60.72	11.39	66.79	18	14.25	122.44	22	14.85	146.95
28	615	171,600	221	22	10.58	68.64	11.64	75.50	18	15.35	149.48	22	16.12	167.81
30	707	196,800	270	20	12.82	74.36	14.10	81.80	20	17.94	171.71	24	18.84	192.96
36	1,017	283,800	450	20	14.90	101.20	16.39	111.32	20	20.62	254.23	24	21.64	286.79
42	1,385	349,800	580	20	18.07	154.00	19.88	169.40	20	25.62	354.97	24	26.87	397.60
48	1,810	504,720	785	20	22.42	228.80	24.66	251.68	24	32.13	562.89	28	34.05	644.30
54	2,290	648,200	990	20	26.77	290.40	29.45	319.44	32	41.67	688.77	36	45.85	757.65
60	2,827	787,800	1,025	18–20	32.04	429.00	35.24	471.90	36	48.63	1,050.06	40	53.49	1,155.07
66	3,421	1,072,740	1,175	18–20	37.85	572.00	41.64	629.20	36	68.07	1,315.65	40	74.88	1,447.22
72	4,072	1,133,640	1,600	16–18	43.35	729.00	47.69	834.90	40	72.24	1,682.28	48	79.46	1,850.51
84	5,542	1,567,800	2,500	14–16	59.15	1,237.50	65.07	1,361.25	42	91.68	2,454.30	48	100.85	2,699.73

These prices do not include bases, condensation arresters, fusible fire links or damper chain.

PRICES, DIMENSIONS, WEIGHTS AND GAGE OF K. S. V. VENTILATORS

Diameter of neck, inches	Price with sliding sleeve damper	Gage of iron	Diameter of outside rim or band, inches	Height of glass top without base, inches	Height of metal top without base, inches	Length of neck from bottom to lower rim of wind shield, inches	Net weight metal top without crating, pounds	Gross weight glass top crated, pounds	Net weight glass top without crating, pounds	Gross weight metal top crated, pounds	Area of diameter in square inches
8	$ 6.00	22	15	11¼	13¼	3½	10	22	12	18	50.22
10	7.00	22	18	12½	15½	4¼	12	24	15	20	78.54
12	8.00	22	22	14	17	4¼	15	30	22	25	113.10
14	12.00	22	24	15	17½	4¼	20	35	24	30	153.94
16	15.00	22	26	15½	19	5	24	46	30	40	201.06
18	19.00	20	29	16	21	5	28	51	34	45	254.44
20	23.00	20	32	18	23	5½	33	70	42	60	314.19
24	27.00	20	38	22	26	6	45	82	56	70	452.39
30	38.00	18	46	24	30	6	90	155	105	140	706.85
36	57.00	18	54	27	36	8	135	245	155	220	1,017.88
40	75.00	18	64	33	40	10	180	295	200	270	1,256.00
42	81.00	18	68	34	42	10	200	335	225	300	1,386.00
48	90.00	18	78	36	46	11	265	430	320	380	1,809.00
54	105.00	18	86	40	51	12½	350	485	375	460	2,390.00
60	120.00	18	94	43	54	14	430	535	425	540	2,827.00
66	135.00	18	102	46	55	15½	500	585	475	610	3,456.00
72	150.00	18	110	51	66	15½	625	775	525	850	4,071.00

CHAPTER XVI

MARBLE AND TILE

TILE WORK

Preparing an Estimate.—In preparing an estimate for tile work there are a number of things that must be kept in mind, such as

1. Quality of tile.
2. Description and location of tile to be used.
3. The various types of corners, caps, bases, etc.
4. The choice of color.
5. The condition of the job when the tile setter is to start work, as for instance the condition of the walls, scratch coat, etc.
6. Setting materials required; mixes for mortar, etc.
7. The method of setting, buttered or floated; condition of the job when completed; walls, plumb, out of wind; kind of joints and the grout to be used.
8. Information for floor tile, same as for the wall.
9. Special requirements such as faience, accessories, etc.; their quality, character, kind of material, special corners, bulkheads to be tiled, and other incidentals.
10. The protection of walls and cleaning upon completion.

PREPARATION OF SURFACE FOR TILE WORK

Floors.—A perfectly solid and level foundation must be provided, free from spring or vibration. A cement concrete bed should be laid at least 2½ in. thick if of stone concrete or 3½ in. thick if of cinder concrete. The surface of this bed should be laid rough, and brought to within 1 or 2 in. of the finished surface, depending upon the thickness of the tile. In new buildings with wooden joists that can be placed low enough, the construction should be as shown in cut "Construction for tile in new buildings."

In old buildings, and also in new, where joists cannot be dropped to leave the desired amount of space, the upper edge of the joists

should be chamfered off to a sharp edge, thus reducing the bearing and the chance of cracking in case of settlement. Cleats should be nailed on the joists 4½ in. below the finished floor line, and rough flooring cut in between. This flooring should not be over 6 in. wide and spaced ¼ in. apart to take care of the swelling of the boards.

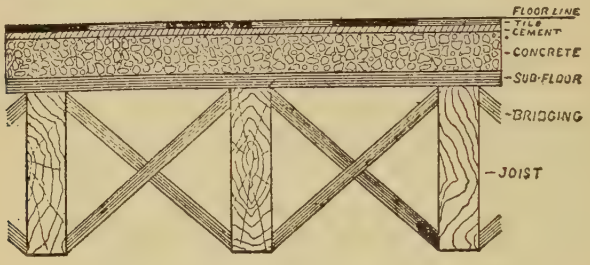


FIG. 1.—Construction for tile in new buildings.

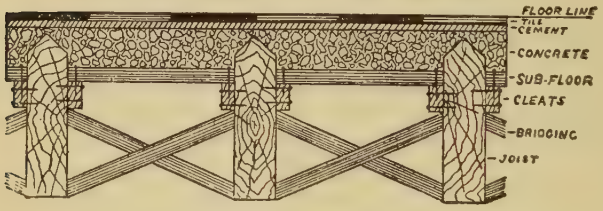


FIG. 2.—Construction for tile in old buildings.

FIG. 3.—Laying tile over iron beams and hollow tile.

A layer of tar paper should be placed over the boards and carried up the joists. Separate pieces should then be put closely over the joists and should overlap those on the boards. This work is well shown in the cut "Construction of tile in old buildings."

The following method of laying tile is given by the Associated Tile Manufacturers, and is therefore reliable:

Floor Binder.—Open and well-painted expanded metal lath or galvanized wire netting shall be placed on top of leveling coat or concrete, overlapping at least 6 in. where more than one width is required Wire netting should be stretched tightly and fastened at ends. This reinforcement will tend to counteract volume changes within the cement mortar as well as distribute strains, and thus prevent floor cracks.

Cement Mortar.—Cement mortar shall consist of one part portland cement and two parts clean, washed sand, thoroughly mixed. Cement mortar must be used while fresh, before it reaches its initial set. Before laying tile, dry cement shall be dusted over the cement mortar to a thickness of about $\frac{1}{16}$ in.

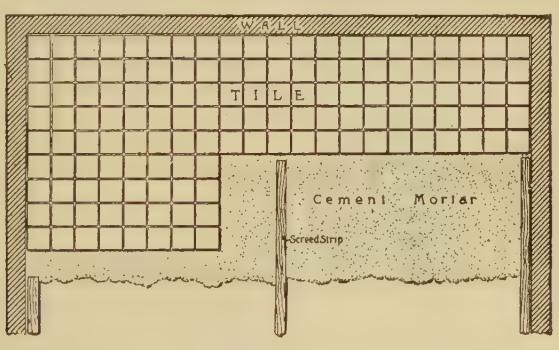


FIG. 4.—Method of laying floor tile.

Laying Floor Tile.—Set screed strips as guides for leveling the cement mortar over as large a section of the floor as possible. The top of strips shall come to within $\frac{3}{8}$ in. of finished floor line (when tiles of $\frac{1}{2}$ in. thickness are to be laid). The surface of the concrete or leveling coat shall then be saturated thoroughly with clean water. Sprinkle dry cement over the concrete to a thickness of about $\frac{1}{16}$ in. With a trowel spread cement mortar between the strips along one end of the room as evenly as possible. Put a screed edgewise over the strips and with a sawing motion distribute and smooth the mortar until the entire surface is true and even with the strips. The larger the area thus covered the better, provided tile can be laid on it before the mortar reaches its initial set. Remove screed strips and fill the grooves with mortar. Sprinkle dry cement over

the mortar to a thickness of about $\frac{1}{16}$ in. This sprinkling of dry cement shall not be done over the entire setting bed at one time, but shall proceed with the laying of the tiles.

All tiles except vitreous, shall be thoroughly soaked in clean water before laying. Tiles shall then be placed upon and firmly pressed into the cement mortar and tamped with block and hammer about $\frac{1}{8}$ in., or until exactly true and even with the finished floor line. When more cement mortar has been spread that can be covered with tile on the same day, all mortar of the unfinished portions shall be removed and brought to a clean, beveled edge along the tile of the finished portion.

Joints shall be grouted with portland cement mixed with water to the consistency of cream. Force the grout into the joints with a flat trowel or thin board. After dry cement has been sprinkled on the floor remove all surplus of the grout with sawdust and excelsior or bagging. All floor tile laid on one day shall be grouted not later than the following morning to insure a proper bond between grouting and cement mortar.

Cleaning Floor Tile.—A white scum, caused by cement, sometimes appears on the surface of the floor tile. This can generally be removed by frequent washings with plenty of soap and water. If this proves ineffective, use diluted commercial muriatic acid (6 oz. of acid to a bucket of water) and apply with a scrubbing brush. Agitate the acid and allow it to remain on the floor for a few minutes only, then wash off thoroughly with clean water.

Laying Ceramic Mosaic Tile.—The border of a ceramic mosaic floor shall be laid before the center in the following manner: Place short screed strips at right angles to the walls of the room and level with the finished floor line. The surface of the leveling coat or concrete shall then be saturated thoroughly with clean water. Sprinkle dry cement over concrete to a thickness of about $\frac{1}{16}$ in. With a trowel spread cement mortar between strips as evenly as possible for a width slightly exceeding that of the border. Put a screed edgewise over the strips and with a sawing motion distribute and smooth out the mortar till it is even with the strips. Sprinkle dry cement over the mortar to a thickness of about $\frac{1}{16}$ in. Mark the inner edge of the border on the mortar with a chalk line. Remove the screed strips, fill grooves with mortar, and proceed with laying the border as follows:

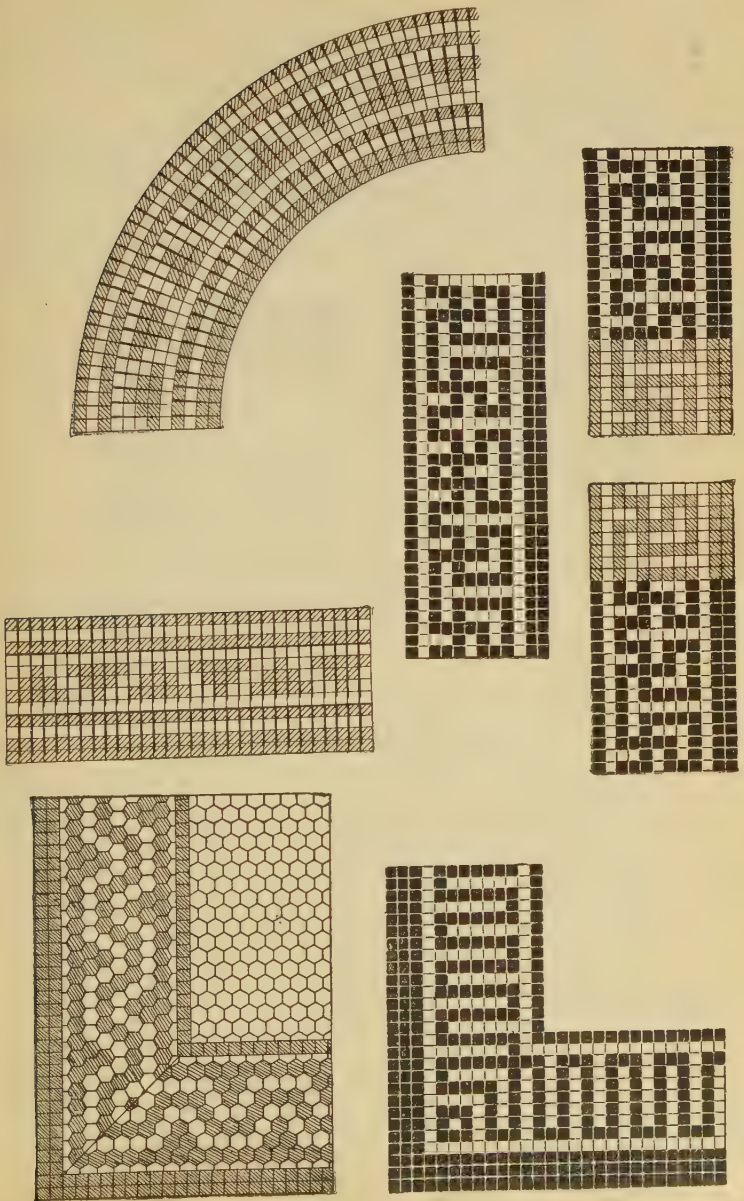


FIG. 5.—Typical mosaic tile patterns.

The inner edge of the border must be kept straight and all cutting of tile for irregularities in the wall line shall be done along the outer edge. Any cement mortar extending beyond the inner edge of the border shall be removed before hardening.

The field of the floor and floors without borders shall be laid as follows: Set screed strips across the room and level with the finished floor line. Saturate the leveling coat or concrete with clean water. Sprinkle dry cement over concrete. With a trowel spread cement mortar between screed strips as evenly as possible. Put a screed

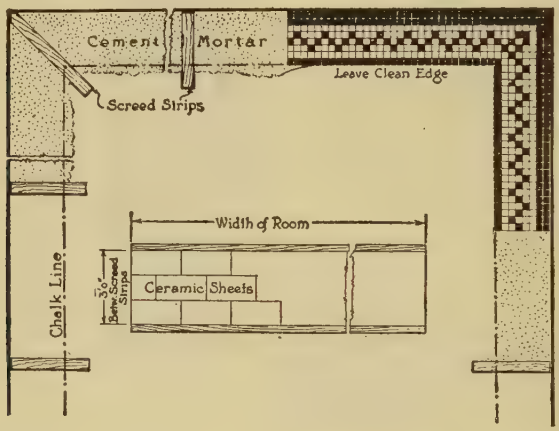


FIG. 6.—Method of laying ceramic mosaic tile.

edgewise over strips and with a sawing motion distribute and smooth the mortar till the entire surface is true and even with the strips. The larger the area thus covered the better, provided the sheets of ceramic mosaic can be laid on it before the mortar reaches its initial set. Remove the screed strips and fill the grooves with mortar. Sprinkle dry cement over the mortar to a thickness of about $\frac{1}{16}$ in. The sprinkling of dry cement shall not be done over the entire setting bed at one time, but shall proceed with the laying of the sheets.

Lay sheets of ceramic mosaic carefully on the mortar. Care must be taken to keep the joints between the sheets of the same general width as those between the mounted tile; the finished floor must not show where the sections join. In large areas of floor work, every

third or fourth row of sheets shall be laid to a straight edge in order to avoid irregularities in the lines and design of the work.

Beat the tile down until the mortar shows in the joints through the paper without breaking the paper however. The paper shall then be moistened, and when well soaked, removed by carefully pulling off backwards, starting with a corner. After removing the paper, sprinkle the tile with a dry mixture of white sand and cement in equal parts before finishing the beating, so that the tile will not adhere to the beater. Corrections of surface shall then be made by leveling with block and hammer.

Where the laying of the entire floor cannot be finished on the same day, the last row of ceramic mosaic including the cement mortar shall be cut off (to be replaced before laying is continued), leaving the finished part of the work with a clean beveled edge.

Joints shall be grouted with portland cement mixed with water to the consistency of cream. Force the grout into the joints with a flat trowel or thin board (not with a broom which often scrapes out the joints). After the dry cement has been sprinkled on the floor remove all surplus grout with sawdust and excelsior or bagging. All ceramic mosaic laid on one day shall be grouted not later than the following morning to insure a proper bond between the grouting and cement mortar. A day or two after grouting, the whole floor shall be rubbed with sharp sand and a piece of soft lumber to remove the last traces of cement.

Hearth.—A concrete foundation shall be placed on a subfloor constructed in the following manner: Lay 2-in. T-irons 8 in. apart, from the brick shelf at the chimney to a cleat nailed along the joist header. Common brick shall then be placed flat upon the irons and the joints filled with portland cement mortar. Sheet or corrugated iron can be used instead of brick (never use wood).

The setting of hearth and facing tile shall then be done in the same manner as directed for floors and walls respectively.

Walls.—A perfectly solid and plumb foundation free from spring or vibration is absolutely necessary.

On Studding.—Studding should be placed 16 in. on centers, thoroughly braced to prevent vibration, and covered with tar paper. Metal lath or expanded metal shall then be fastened securely on the studding.

On Brick Walls.—Some of the mortar must be raked out of the joints of brickwork to provide a proper key for the scratch coat. Before

applying the scratch coat saturate the wall thoroughly with clean water.

On Cork Insulation.—Where tile is to be set on cork insulation (as for refrigerators or cold storage boxes), wire netting or metal lath shall be securely fastened to this insulation and the scratch coat shall contain waterproofing compound to prevent condensation from penetrating it.

On Gypsum Blocks.—When placed on gypsum blocks, these blocks shall be coated with waterproof paint and a wire netting or metal lath securely fastened to them, or holes shall be punched into the blocks to provide a proper anchor for the scratch coat.

Never on Wood or Plaster.—Tile shall never be placed on wood lath or lime plaster.

Scratch Coat.—The scratch coat shall consist of one part portland cement and two parts clean, washed sand. Thoroughly mix the cement and sand dry, and add sufficient water to form a thick mortar. On metal lath, the scratch coat should be ½ in. thick, or sufficient to make an even true surface to within ¾ in. of finished wall surface (when tile of ⅜ in. thickness are to be used). The scratch coat shall be scratched horizontally, and allowed to harden for at least one day before commencing to set tile. It shall then be brushed to remove all dust, and thoroughly saturated with clean water.

Cement Mortar.—Cement mortar shall consist of one part portland cement, two parts clean, washed sand, and not more than 15 per cent of well slaked lime, thoroughly mixed. Great care must be taken to have the lime well slaked, and free from all lumps by passing through a fine sieve. (This guards against "heaving" or "swelling," and thus against "loosening" or "lifting" of tile.) Hydrated or finishing lime can be used. Before setting tile, and after carefully placing the last coat of cement mortar to receive the tile, apply with a plasterer's trowel a very light coat of pure portland cement mixed with water to the consistency of thick cream.

Soaking Tile.—All tile, except vitreous, shall be thoroughly soaked in clean water before placing on the wall. Dirty water or water off cement will stain tile, causing a variation in shade and an unsatisfactory job.

Setting Tile for Walls or Wainscoting.—Done by one of two methods: Floating or buttering. Good work can be done by either method.

When a cove based is used, it may be set first. In all cases it must be well supported on the concrete. If guide strips are used temporarily in place of base they must be even with finished wall line.

Floating Wall Tile.—Soak wood laths of about 30-in. lengths in water and then place them as guide strips on the wall to be tiled by putting a small amount of cement mortar on one side of the laths. Apply plumb rule, and tap the laths against scratch coat until they

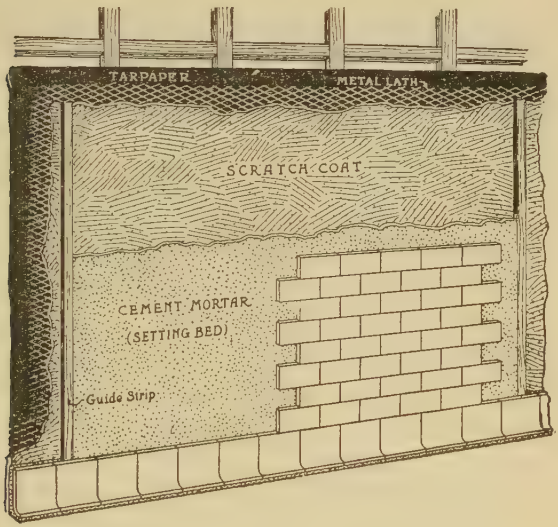


FIG. 7.—Method of setting wall tile by floating.

are perfectly plumb. With a large brush thoroughly saturate scratch coat with clean water and then apply cement mortar with hawk and plastering trowel, bringing the coat of cement as nearly flush with laths as possible. Then use a flat rod by placing it edgewise against the wood laths and "sawing" it from the bottom up until an even coat results. Before placing tile on this coat, remove the wood lath guide strips and fill the grooves with cement mortar. Then mix a small quantity of pure cement, quite thinly, and apply a small amount on the back of each tile, place tile on the wall, and beat

it carefully with block and hammer. Never rub face of tile with the block, since it will surely cause scratches.

Buttering Wall Tile.—After tile base is set, the wall shall be spotted about 30 in. apart, with small pieces of tile (fastened with mortar) which must be absolutely plumb with face of finished wall. These spots are to act as guides to make the tile wall or wainscot perfectly plumb. With a large brush thoroughly saturate the scratch coat with clean water. Apply a small amount of neat portland

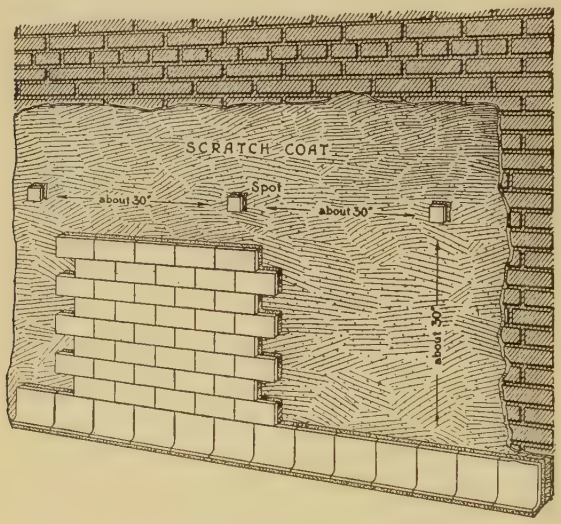


FIG. 8.—Method of setting wall tile by buttering.

cement on the back of each tile. Spread the proper amount of cement mortar evenly on the back of each tile, place tile on the wall, and tamp gently until firmly united with the wall and plumb with the spots, frequently using a wooden straightedge which reaches from lower course of tile or base to all the spots. Any tile projecting beyond or receding from the straightedge shall be tamped or brought out as may be necessary to insure a plumb and straight wall.

Every fourth course of tile shall be brought to a level and straight line by inserting small wooden wedges between the joints. These

wedges are to be removed after tile is set and before grouting is done.

Grouting.—After all tile is set, the joints must be carefully washed out and neatly filled with thinly mixed white or light-gray portland cement (white cement should always be mixed in a porcelain or enameled vessel; if mixed in a tin, it is apt to be discolored by rust and show yellow stains after drying).

All traces of cement on the surface of tile must be wiped off carefully before hardening.

Fixtures.—Bathroom fixtures shall be attached to the wall by drilling through the tile and fastening them with screws set in metal expansion shells of proper size.

Crazing.—Crazing of wall tile is absolutely unavoidable in some cases owing to the difference of the units of expansion and contraction between the biscuit and the glaze of the wall tile.

No factory will guarantee their product against crazing. It is possible, however, to minimize the chance of crazing if no sudden changes of temperature are allowed in the room in the process of setting, and it is always recommended that not too heavy a setting bed be used on wall tile as this also tends to cause crazing.

Swimming Pools.—The setting of tile in swimming pools differs from other work only insofar as there are a great many small details that must be watched. Great care should be used in the detailing of the goose neck scum gutter; and in the preparation of the swimming pools, the scratch coat should be rodded and kept plumb and even. In this case, the setting bed behind the tile should be as small as possible as too heavy bed allows the tile to slip away and makes it very difficult to control the straightness of the joint lines.

Bathroom Accessories.—Tile bathroom accessories are becoming quite popular and are very convenient. The accompanying cut and prices are furnished through the courtesy of the Fairfacts Company, Inc., of New York City. The prices are list prices and subject to small discounts, but as these fixtures are usually installed by the tile man, the discount will probably not be more than his profit, and hence the cost in place would be approximately the amount shown on the list, plus the time for installing.

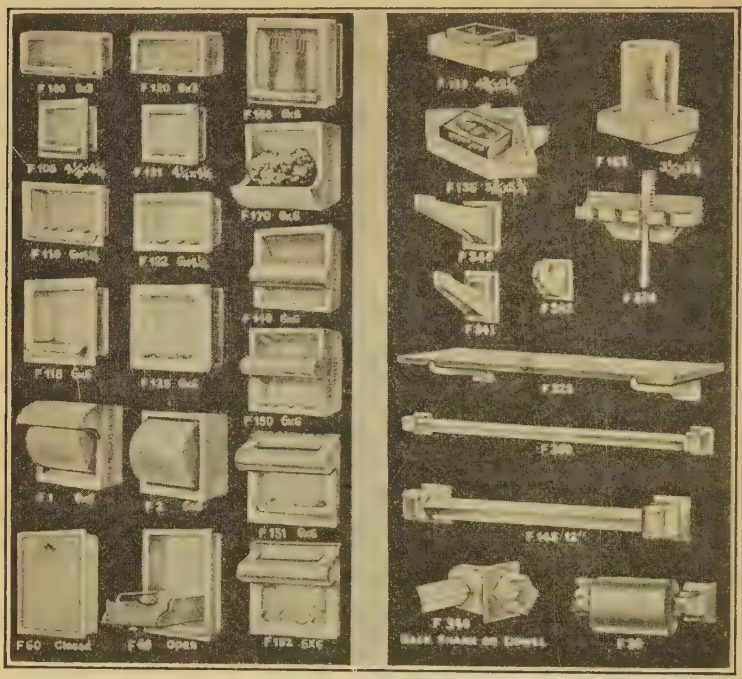


FIG. 9.—Fairfacts China Bathroom Accessories.

Patented

No.	SIZE	PRICE EACH	No.	SIZE	PRICE EACH
F1	6 by 6	$5.00	F135	5¾	$2.50
F2	6 by 6	3.00	F140	6 by 6	5.00
F30		3.00	F145	12 long	5.00
F60	8 by 10½	10.00	F150	6 by 6	5.00
F100	6 by 3	2.00	F151	6 by 6	5.00
F105	4¼ by 4¼	2.50	F152	6 by 6	5.00
F110	6 by 4¼	2.50	F160	6 by 6	2.50
F115	6 by 6	2.50	F165	3¼ long	2.00
F120	6 by 3	2.00	F170	6 by 6	4.00
F121	4¼ by 4¼	2.50	F330	6 long	2.00
F122	6 by 4¼	2.50	F340	4½ long	1.10
F125	6 by 6	2.50	F341	3½ long	1.10
F130	4¾ long	2.00	F342	2 long	1.10

Towel Bars

⅞ in. square non-slip towel bars	Use letter F
1 in. round white glass bars	Use letters F and W
1 in. round crystal glass bars	Use letters F and C
1 in. round white pyralin bars	Use letters F and P

Sizes are c. to c. of posts—Prices are for one bar and two posts.
42 and 48 in. bars have center post included in price.

Towel Bars and Posts with Back Shank or Dowel

18 Inches		24 Inches		30 Inches	
F300	$3.75	F301	$4.00	F302	$4.50
F300W	3.75	F301W	4.00	F302W	4.50
F300C	3.75	F301C	4.00	F302C	4.50
F300P	3.75	F301P	4.00	F302P	4.50
Ex. Heavy Bars 1⅛ in. square.				F313	8.00
36 Inches		**42 Inches**		**48 Inches**	
F303	$5.00	F304	$6.25	F305	$7.25
F303W	5.00	F304W	6.25	F305W	7.25
F303C	5.00	F304C	6.25	F305C	7.25
F303P	5.00	F304P	6.25	F305P	7.25
F314	9.00	F315	10.00	F316	11.00

Towel Bars and Posts with 6 by 3 Clincher Back

18 Inches		24 Inches		30 Inches	
F430	$5.50	F431	$6.25	F432	$7.00
F430W	5.50	F431W	6.25	F432W	7.00
F430C	5.50	F431C	6.25	F432C	7.00
F430P	5.50	F431P	6.25	F432P	7.00
36 Inches		**42 Inches**		**48 Inches**	
F433	$7.75	F434	$8.50	F435	$9.50
F433W	7.75	F434W	8.50	F435W	9.50
F433C	7.75	F434C	8.50	F435C	9.50
F433P	7.75	F434P	8.50	F435P	9.50

Towel Bars and Posts with 4¼ by 4¼ Clincher Back

18 Inches		24 Inches		30 Inches	
F530	$6.00	F531	$6.75	F532	$7.50
F530W	6.00	F531W	6.75	F532W	7.50
F530C	6.00	F531C	6.75	F532C	7.50
F530P	6.00	F531P	6.75	F532P	7.50
36 Inches		**42 Inches**		**48 Inches**	
F533	$8.25	F534	$9.00	F535	$10.00
F533W	8.25	F534W	9.00	F535W	10.00
F532C	8.25	F534C	9.00	F535C	10.00
F533P	8.25	F534P	9.00	F535P	10.00

White Glass Shelves

5 In. Wide, 7/16 In. Thick with China Brackets

Prices are for one Shelf and Two Brackets

Shelves and Brackets with Back Shank or Dowel

Length	20 Inches		24 Inches		30 Inches	
Shelf Rests on Bkts	F320	$4.80	F321	$5.50	F322	$6.00
Shelf Bolts to Bkts	F325	4.80	F326	5.50	F327	6.00

Shelves and Brackets with 6 by 3 Clincher Back

Shelf Rests on Bkts	F460	$6.80	F461	$7.50	F462	$8.00
Shelf Bolts to Bkts	F465	6.80	F466	7.50	F467	8.00

Shelves and Brackets with 4¼ by 4¼ Clincher Back

Shelf Rests on Bkts	F560	$6.80	F561	$7.50	F562	$8.00
Shelf Bolts to Bkts	F565	6.80	F566	7.50	F567	8.00

Recess Medicine Cabinets

No.	Size O. A.	Price Each	No.	Size O. A.	Price Each
F999	18 by 24	$20.00	F2000	19 by 23	$50.00
F1000	21 by 27	25.00	F2001	22 by 28½	55.00
F1001	23 by 29	30.00	F2002	34 by 32½	60.00
F1002	25 by 31	36.00			

Boxing, etc., Extra F.o.b. Our New York City Warehouse

Manufacturers

The Fairfacts Company, Inc., New York

Time Required for a Man and a Helper to Set Tile Work.—The amount of tile work that can be installed per day will vary with the size of the rooms, the number of corners and the size of the job. Men will install on straight-away work twice as much as they will on work where the space is broken up with many corners and irregular shapes. The following table gives the average amount that a man and helper can do in a day of 8 hr. under ordinary circumstances:

Ceramic tile floors	100 sq. ft.
Quarry tile laid with ¼ in. joints, including grouting	90 sq. ft.
Faience with spread joints	35 to 60 sq. ft.
Vitreous tile, sizes from 2⅛ to 6 in. units	50 to 75 sq. ft.
6 in. sanitary round top, cove bottom base	100 lin. ft.
Tile wainscot	50 to 70 sq. ft.

Tile set with broken bonds requires a little less labor than with unbroken bonds. The above figures are for the labor of setting only and do not include the time for hoisting of materials or for cleaning at the end of the job. In a room with small spaces and many corners, the men will not do more than the small figures given above and for very small areas even less, while for straight-away work capable men may do somewhat more than the larger figures shown in the table. No account is taken in the table for lost time due to mistakes either of the tile setters or of other tradesmen in preparing the rooms for the tile. It is sometimes necessary to cut back the walls that have been built out too far as well as to fill in where the walls have been left too far back of the finish line. Some such errors usually occur in most jobs and an allowance of 5 per cent would probably not be too much for these and similar conditions.

COST OF TILE WORK

(Per square foot)

Ceramic floors	White	Blue, green, celudon, pink and vitreous gray	Other colors
1 in. hexagon, ¾ in. squares, 1¾6 in. rounds	$1.00	$1 25	$1.10
½ by 1 in., ¾ by 1½ in. herringbone, 1¼ in. hexagon	1.10	1.38	1.21
2 in. hexagon	1.25	1.50	1.35
2⅛ by 2⅛ in. squares	1.38	1.65	1.49
3 by 3 in. squares	1.44	1.73	1.55
4¼ by 4¼ in. squares	1.63	1.95	1.75
6 by 6 in.	1.88	2.25	2.03

6 by 6 in., 9 by 9 in., 6 by 9 in. red quarry tile	$1.10
4 by 4 in., 3 by 3 in., red quarry tile	1.20
12 by 12 in. red quarry tile	1.60
Faience floors—from	$1.75 up
Mosaic floors—	
¾ in. cubes, Italian or Tennessee marble	$1.50
¾ in. cubes, other marbles—from	1.60 to 2.00
Special designs—from	2.50 up

Walls	Glazed		Matte	
	White	Colors	White	Colors
6 by 3 in. glazed tile wainscot, 3 ft. 6 in. to 7 ft. 6 in. high with base and cap	$1.25	$1.75	$1.88	$2.16
4¼ by 4¼ in. glazed tile wainscot, 3 ft. 6 in. to 7 ft. 6 in. high with base and cap	1.30	1.82	1.95	2.24
6 by 6 in. glazed tile wainscot, 3 ft. 6 in. to 7 ft. 6 in. high with base and cap	1.35	1.89	2.03	2.34
6 by 3 in. glazed tile wainscot, under 3 ft. 6 in. or over 7 ft. 6 in. with base and cap	1.44	2.02	2.16	2.48
4¼ by 4¼ in. glazed tile wainscot, under 3 ft. 6 in. or over 7 ft. 6 in. with base and cap	1.50	2.10	2.25	2.59
6 by 6 in. glazed tile wainscot, under 3 ft. 6 in. or over 7 ft. 6 in. with base and cap	1.55	2.17	2.33	2.68

Ceramic tile wainscot including base and cap, white	$1.25
Ceramic tile wainscot including base and cap, colors	1.38
Quarry tile wainscot, 6 by 6 in., 9 by 9 in., 6 by 9 in	1.27
Quarry tile wainscot, 4 by 4 in., 3 by 3 in.	1.38
Quarry tile wainscot, 12 by 12 in.	1.84
Faience tile—from	2.00 to 15.00

INTERIOR MARBLE

Interior marble work is usually installed by sub-contractors specializing in this line, and it is only being thoroughly familiar with the cost of material and the labor required that permits an accurate estimate to be made for any given job. There is a large variety of both domestic and imported marbles. Some of them are easily worked and require no waxing or filling of cracks, while others are difficult to work, the material is very expensive and much waxing and special work is required to make a satisfactory finish.

Time to Install Marble Work.—The time shown in the following table is for a mechanic and a helper, and the table gives the amount of work that will ordinarily be installed in a day of 8 hr. in an average sized room under ordinary conditions:

Marble flooring tile with units of 10 by 20 in. in unwaxed marble (Vermont, Tennessee, Georgian, Italian, etc.)	85 sq. ft.
Marble flooring tile units of 10 by 20 in. in waxed marbles (practically all highly colored marbles)	60 sq. ft.
Marble base 6 or 8 in	75 lin. ft.
Wainscot 5 ft. high including base, die and cap, unwaxed	100 sq. ft.
Wainscot 5 ft. high including base, die and cap, waxed	50 sq. ft.
Toilet marble including partitions, stiles, etc	100 sq. ft.
Fireplaces complete including hearth, facing, rear hearth, back and jambs	1 complete
Marble door saddles	45 lin. ft.
Plinth blocks	20 pieces

In the above figures for floor work the labor given includes waxing the seams, polishing and finishing. In the labor for toilet marble men will do somewhat more than shown on partitions 5 by 5 ft., but considerable less than the amount given for stiles and caps.

Average Price of Marble Work Installed in Place

Interior Plumbing Marble

White Vermont Wainscot

	Square Foot
⅞ in	$2.25
1 in	2.45
1¼ in	2.60
1½ in	3.00

Partitions, pol. 2 faces and edges

⅞ in., 1 in., 1¼ in., 1½ in. ..... add 40 per cent per square foot

Stiles, 6 in. wide or under polished faces and edges

1¼ in	$2.50 lin. ft.
1½ in	3.00 lin. ft.

Same, 6 to 12 in. wide

1¼ in	$3.00 lin. ft.
1½ in	3.50 lin. ft.
⅞ w. c. templates	2.50 each
Urinal floor slabs	2.00 sq. ft.
Countersunk, etc	5.00 sq. ft.
Pink, grey or dark Tennessee	add 15 per cent
White Italian	add 5 per cent

Interior Marble

White Vermont

Steps, plain nosed, not over 12 in. wide, 1¼ in.	$1.00 lin. ft.
Risers, ⅞ in. honed, or pol. not over 8 in. high	1.35 lin. ft.
Saddles	1.20 lin. ft.
Plinths	1.50 each up
Base, 6 in. or 8 in. pol	1.65 lin. ft.
Base, 10 in. or 12 in. pol	1.80 lin. ft.
Floor tile	1.27 sq. ft.
add 50 per cent for designs	
Pink, grey or dark Tennessee	add 25 per cent
Italian white	add 30 to 45 per cent

Marble Wainscot

Interior marble wainscot including cap 1¼ in., base 1¼ in.,	Square Foot
die ⅞ in., white Italian	$3.50
Tennessee	3.75
Botticini	4.25
Siena	5.25
Black and gold	5.00
Hauteville	4.75
Alps green	5.50
American green	4.50
English vein, Italian	

For moldings, add $1.50 per lineal foot for each member up to seven members, then $2 additional per lineal foot for each additional member.

The above prices are based on the cost of marble in place in cities where the labor can be had without paying traveling expenses and board. In small towns about 10 per cent should be added to take care of these items.

TERRAZZO WORK

While the cost of terrazzo work does not vary as much as the cost of marble, there is considerable variation due to location, size of rooms, kind of material and whether or not brass strips are to be included. Pattern work and colored borders will also cost more than plain work.

Labor to Install Terrazzo.—The amount of terrazzo that a mechanic and a helper can install in an 8-hr. day is as follows:

Plain work including foundation, rubbing and finishing	200 sq. ft.
Brass strip work	100 to 160 sq. ft.
Sanitary base, round top and cove bottom	70 lin. ft.

Cost of Terrazzo Floors.—One-half to three-fourth inch thick, plain terrazzo fairly good sized fields, without borders in plain color of white or Tennessee, approximately ..... $0.60 sq. ft.
Same with brass stripping in plain design ..... 0.90 sq. ft.
Colored granite adds from 15 to 25 cts. per foot to the above price.

CHAPTER XVII

SPECIAL FLOORING

MASTIC FLOORS

Where Used.—Mastic floors should be used only where other floors would not be satisfactory. Their use is limited almost entirely to places where the sun does not shine and where there is no unusual heat, except in special cases where they are required for battery service or other places requiring an acidproof flooring. Because of their natural tendency to self-healing when warm, they are suited to places where there is considerable shock or vibration. They are soft and spongy at all times, especially during the summer season. No other flooring has been found that will close up cracks and other defects to an equal degree. They are often used in warehouses and for the storage of materials that are likely to leak, such as liquids in barrels, where there would be danger of spoiling material stored on the floors below. They are frequently used for interior playgrounds because of their resiliency and added safety for athletic purposes. Mastic floors are also used in dipping rooms for electro-plating, glass factories, etc.

One of the detrimental factors in the use of mastic is the tendency to show the imprints of truck wheels, heavy boxes, etc., especially in hot weather, and to some extent even in cold weather. Many have attempted to make a mastic hard enough to avoid this, but it can only be prevented by the use of sand grit or other siliceous materials. This necessarily detracts from its waterproof, acidproof and resilient qualities to a considerable extent.

Composition.—The mastic consists in general of a mined product which is mixed with a sand or silica aggregate to such an extent as to permit of its being shipped in blocks except in the case of asphalts from Trinidad or Venezuela. These are brought here in crude form and are manufactured into cakes in this country.

Mixture.—The proper mixture for an ordinary asphalt floor is 600 lb. of block, 80 lb. of soft asphalt or flux and 500 lb. of grit. This represents the contents of a full sized wood burning kettle which will lay approximately 100 sq. ft. of a 1-in. floor.

Cost.—The cost of mastic floors in the vicinity of New York City at the present time is approximately 25 cts. per square foot 1 in. thick,

and in the same ratio for thicker floors. Acidproof work usually costs about 3 cts. per square foot more. The above price includes the contractor's overhead and profit.

As most of the asphalt is received by water transportation, the cost is more for cities further from the coast. The weight is about 12 lb. per inch foot. Only 7 lb. per foot, however, need be shipped as the grit can be obtained locally.

LINOLEUM AND CORK CARPET FLOORS

Because of their durability, neat appearance, noiselessness and fire-resisting qualities, linoleum and cork carpets are coming into quite common use for halls, offices, schools, etc.

Linoleum is made 2 yd. wide and put up in rolls containing approximately 60 sq. yd. It is furnished in the following colors: Brown, green, gray, tan and black. It is made in Solid color, Jaspè, Granite or Inset. The inset is made to imitate various kinds of tile and carpet.

TABLE OF LINOLEUM

Gages	Thickness, inches	Average weight, pounds per square yard	Gages	Thickness, inches	Average weight, pounds per square yard
Plain linoleum					
Battleship (¼ in.)	¼	12.5	Parquetry inlaid	⅛	7.3
Battleship (6 mm.)	¼	11.5	Armstrong's inset tile linoleum	⅛	7.3
Battleship (3/16 in.)	3/16	9.0	Armstrong's straight line inlaid		
Light battleship	⅛	8.0	*A* gage	⅛	7.3
A gage	⅛	8.0	*D* gage	1/16	
B gage	⅛	6.5			
C gage	⅛	5.5	Armstrong's granulated inlaid		
D gage	3/32	4.3	*B* gage	3/32	
Jaspè' linoleum			*C* gage	3/32	
A gage	⅛	8.5			
B gage	⅛	7.0	*D* printed	3/32	
Granite inlaid	3/32	5.2	*E* printed	1/16	
Carpet inlaid			Cork carpet (polished or unpolished)		
B gage	⅛	....	XXX gage	¼	7.5
C gage	3/32	....	XX gage	¼	6.5

Laying Linoleum.—Linoleum should never be laid in a room when the temperature is below 70°F. In cold weather it should not be unrolled until it has been subjected to a temperature not lower than 70°F. for at least 48 hr.

Laying on Wood Floors.—Linoleum should not be laid directly on wood floors but over a deadening felt. The best felt for this purpose is the ordinary gray unsaturated felt of about ⅛ in. thickness and weighing 1½ lb. per square yard. It comes in rolls 3 ft. wide and 10-, 25-, 50- and 100-yd. lengths. The felt should be pasted to the floor and then the linoleum to the felt. One gallon of paste will cover about 100 sq. ft. for one operation. Hence it requires a gallon for about 5 yd. of floor area for the two operations. When linoleum is laid directly on the floor, 1 gal. of paste is required for 10 yd. of floor area. It is best to stop the paste about 4 in. back from the edge of each strip and, when the paste is well set, the edges should be sealed with waterproof linoleum cement. One gallon of cement will cover about 60 sq. ft., and when used only on the seams 1 gal. is required for every 40 yd. of linoleum. In laying the linoleum when there is no pattern it is best to let the strips overlap by ½ in. or more and then trim by cutting through the two at once, thus making a perfect joint. Both the felt and the linoleum should be rolled with a hand roller weighing not less than 150 lb., using sand bags or bricks along the seams when required to prevent bulging. When laying linoleum with a pattern the edges are not trimmed but butted and the ends cut so as to match the pattern.

Laying Linoleum over Concrete Floors.—The best method is to lay the linoleum over a deadening felt, in which case the method is just the same as when laying over a wood floor. The felt is first pasted to the cement and then the linoleum pasted and the seams cemented in the same manner as when laid over wood floors. A good job, however, can be done when the floor is smooth and in good condition without using the felt, by laying the linoleum directly on the concrete. This is the same as when laid on a wood floor except that the lining or deadening felt is omitted.

Waxing Linoleum Floors.—Linoleum will last longer and can be cleaned much more easily if waxed. Before the wax is applied the floor should be carefully cleaned, using a mild soap free from alkali, then rinsed with clean water and thoroughly dried. In waxing, the process is very similar to waxing wood floors, using either Johnson's

Liquid Wax, Old English Linoleum Wax or others of equal merit. The wax should be applied sparingly and rubbed in.

Cost of Laying Linoleum.—The following information on the cost of laying linoleum was furnished by an experienced linoleum contractor.

Under average conditions an experienced linoleum layer should lay 25 yd. per day on any surface, or 15 yd. per day including a felt base. The present wages for linoleum layers in New York City is $1.25 per hour. At this rate the cost of linoleum in place is about as shown in the following table. This table has been compiled to show the cost per square foot of linoleum when laid on a wood or concrete base including the felt. Exact figures can be obtained only by using the local market price for labor and material.

Business floors	Cost per square foot laid	Residence floors	Cost per square foot laid
Battleship linoleum		Inset marble tile	$0.35
¼-in. brown (heavy)	$0.34	Inset tile	0.33
¼-in. green (heavy)	0.36	Parquetry inlaid linoleum	0.33
¼-in. gray (heavy)	0.36		
3/16-in. brown (medium)	0.27	Hamilton straight line inlaid	
3/16-in. green (medium)	0.28	*A* gage	0.26
3/16-in. gray (medium)	0.28	*B* gage	0.20
A gage brown (light)	0.22		
A gage green (light)	0.23	Carpet inlaid	
A gage gray (light)	0.23	*B* gage	0.22
		C gage	0.20
Inset marble tile	0.35		
Inset tile	0.33	Jaspè (all colors)	
Parquetry inlaid	0.33	*A* gage	0.27
Hamilton straight line inlaid		*B* gage	0.24
A gage	0.26	Granite	0.22
Jaspè (all colors)		Printed	
A gage	0.27	*D* gage	0.16
B gage	0.24	*E* gage	0.15

Cork carpet XXX gage	$0.26
Cork carpet XX gage	0.24

COMPOSITION FLOORS

Description.—Composition floors are frequently referred to as sanitary floors, and sometimes as magnesite floors. They are known

also by various trade names. The material of which they are composed consists of magnesite, color, asbestos and other mineral fillers. The material is usually shipped dry and mixed on the job. It is laid in a plastic state and is usually ½ in. thick when finished. The floor is laid in two coats, the under coat being 3/16 in. thick, and the wearing surface or upper coat 5/16 in. thick. It is fireproof, waterproof, resilient, quiet and sanitary. It can be made up in the following colors: Gray, slate, brown, chocolate, buff, red, green and black.

Cost of Floors.—The cost of this kind of flooring, in ordinary colors, is approximately 30 cts. per square foot in place. Blue and green colored floors will cost 5 cts. per foot more. The cost of a 6-in. sanitary base is about 35 cts. per running foot for plain colors and 40 cts. per running foot for blue and green.

Specifications.—The following specifications and directions for installing composition floors are for the purpose of giving the estimator an idea as to the work involved. Where indicated on the plans, a magnesite composition floor is to be laid with a 6-in. sanitary cove base with round bull nosing. When an underfloor of wood is used to support the composition, it must be laid level to form a plane surface. The wood flooring shall be face nailed. Where grades occur, the beams shall be blocked up or set to the required grade. When magnesite floors are laid on concrete, the concrete shall be finished within ½ in. of the finished floor level. In case electric conduits and other piping are required on the concrete slab, a cinder fill of 1 part cement to 6 parts of cinders must be provided by the general contractor, and leveled at least 1 in. above the top of the pipe. This cinder fill is brought to within ½ in. of the finished floor line ready to receive the composition flooring. Where a sanitary base occurs in these areas, the general contractor shall furnish cement backing of a 1 to 2 cement mortar mix flush with the finished plaster line. Upon completion the contractor must clean and oil these floors and remove therefrom all efflorescence. In some cases he is required to furnish a 2-yr., guarantee to the owner and architect against improper workmanship or materials.

Directions for Installing.—Magnesium chloride is a material that resembles ice. It is broken up and dissolved in water, adding the water gradually until the strength of the solution is 22° Beaumé. At an average temperature of 70° about 4½ lb. of chloride are required to 1 gal. of water to produce 22° Beaumé. The dry material is then

mixed with the chloride solution to the consistency of fresh putty. A wooden darby is used to spread the material on the floor. After about 2 hr., or when under the pressure of the fleshy part of the thumb an indentation is made but no slipping occurs, it is smoothed with a steel trowel held at a slight angle to the surface by going over the floor once. After an interval of three-quarters of an hour it is again troweled, holding the trowel flat to the surface. This is called "straightening up." The material is then allowed to set until it does not show any indentation under the pressure of the fleshy part of the thumb, but is still soft enough for the thumb nail to dent it. It is then troweled hard, holding the trowel at an angle of about 30 deg. to the floor. The floor is then allowed to dry and should be waxed or oiled a week later.

Care of Floor.—If the floor is taken care of in the following manner it will give longer service and will have a better appearance. The floor should be washed with either cold or lukewarm water. Hot water, potash, lye or strong caustics must never be used. A little kerosene in the water is desirable or a mild soap may be used. Good results are obtained by occasional mopping with kerosene, using water-white, not the yellow kerosene. This will remove grease spots. About once a month floor oil or floor wax should be applied, the first for a dull gloss, the latter for a polish.

CHAPTER XVIII

PAINTING

A good job of painting is dependent on the quality of the materials and the skill of the painter. When durability and appearance are essential, the best materials and workmanship are the cheapest in the end. The cost of the best paint is only a minor item in the cost of the entire painting job, the cost of labor being the predominating factor. The small saving effected in applying an inferior paint that will crack and peel in a short time is false economy. The cost of painting involves not only the cost of the paint and the labor of applying it, but also the overhead, which includes shop expense, scaffolding, brushes, tools, mixing, etc. No attempt has been made to cover the overhead, which varies with different contractors, the size of the shop and the efficiency of its management.

Covering Capacity.—The number of square feet a gallon of paint will cover differs according to the kind and color of the paint, the kind of surface, the quality of the thinner, whether of oil, turpentine or varnish, and to what extent it is brushed out. A fine pigment will cover more surface than a coarse one. An opaque pigment will hide or cover better than a semi-transparent pigment. A dark colored paint will cover more surface than white or light tints. Thin paint covers a greater area than thick paint but does not hide the surface as well. A gallon of any paint will cover less on a soft, porous, dry surface than on a hard, well-filled surface.

By brushing the paint out to the limit, any paint will cover more surface than when it is simply flowed on or brushed out ordinarily well. A good paint applied in several coats well brushed out will make a better job than a thick paint flowed on.

The average covering capacity of white or light tinted paint on weatherboarding is 350 sq. ft., smooth matched boards 500 sq. ft., brick 225 sq. ft. and smooth concrete 300 sq. ft. per gallon, one coat. For gray, tan, buff, etc. on weatherboarding 400 sq. ft., smooth matched boards 650 sq. ft., brick 350 sq. ft. per gallon, one coat.

For rough cast stucco 200 to 225 sq. ft. should be figured per gallon, one coat.

QUANTITIES OF MATERIAL REQUIRED TO MIX 1 GAL. OF PAINT
(New work (wood) outside)

Ingredients	Priming coat	Second coat	Third coat
Pure white lead	11 lb.	16⅔ lb.	14¼ lb.
Pure raw linseed oil	4 pt.	2 pt.	4½ pt.
Pure turpentine	1⅔ pt.	2 pt.	⅛ pt.
Pure drier	⅛ pt.	⅕ pt.	⅛ pt.
Square feet it will cover	575 sq. ft.	600 sq. ft.	600 sq. ft.
Pure white lead	14¼ lb.	14¼ lb.	
Pure raw linseed oil	2¼ pt.	4¼ pt.	
Pure turpentine	2¼ pt.	⅛ pt.	
Pure drier	⅛ pt.	⅛ pt.	
Square feet it will cover	600 sq. ft.	600 sq. ft.	

The following is an extract from a publication of the U. S. Dept. of Agriculture:

Brushes.—Probably the most generally useful brush is a round one with bristles about 6 in. long. Oval brushes from 2 to 2½ in. wide are also very good for general use, and a great deal of painting is done with 4- or 5-in. flat brushes. Of these three types it is difficult to say which is the best, different painters having their own individual preferences. The advantage of a flat brush is that a greater amount of surface is covered at a stroke, with the disadvantage that the paint cannot be as thoroughly rubbed in. On the whole, therefore, it is best to use a round brush. The 6-in. bristles are too long for proper working, and before being used a piece of cloth should be tied around the brush about 4 in. from the end of the bristles and 2 in. from the binding. As the bristles are worn off, this sleeve or bridle, as it is called, may be pushed back, thus materially lengthening the life of the brush. For painting sashes and other small surfaces smaller brushes are necessary, the most satisfactory being the small oval brushes with a chiseled end. For varnishing, oval or flat brushes with somewhat shorter bristles are generally used. For the application of whitewash and calcimine a very much larger brush may be used, since these are applied lightly to the surface and are not rubbed in. A flat 8- or 9-in. calcimine brush may be used with practically as much ease as a smaller one.

In addition to the paint brushes, dusting brushes made of stiff bristles are useful for cleaning the surface before painting. For cleaning rusted metal surfaces, steel-wire brushes (2 or 3 in. wide and 6 in. long with wires about 3 in. long) are frequently necessary.

Tools. – If ready-mixed paints are bought, the cans may serve as buckets, but if the paint is mixed from a paste a strong tin bucket large enough to allow for stirring the paint will be necessary. Scraping knives and putty knives are necessary tools for the painter, and it is well to have one or two of each. A paint strainer is useful, but two thicknesses of cheesecloth tied over the top of a bucket answers practically as well. Paint should be strained before using.

Care of Brushes.—Brushes for applying oil paints must be well cleaned after using, though for keeping overnight it is generally sufficient to wrap them in several thicknesses of paper. Some painters keep their brushes overnight by putting them in water. If, however, the brush is not to be used for several days, the paint should be washed out of it. Turpentine is one of the most satisfactory materials for washing a brush, but it is expensive, and a brush can generally be washed as well with kerosene which is much cheaper. After washing off the paint with kerosene the brush should be rinsed with gasoline or benzin, then thoroughly shaken and well washed with soap and warm water. As soon as this washing is complete the brush should be shaken thoroughly so as to throw as much water out of it as possible and hung up with the bristles down to dry; when dried the brush should be thoroughly protected from dust. If much painting is being done it is less trouble to keep the brushes in turpentine or kerosene. For this purpose hooks should be fastened on the inside of a pail with a close-fitting cover, the brushes being suspended either by holes in the handles or by loops of string, so that the brushes hang in the kerosene or turpentine in the bottom of the pail. The bristles should be submerged in the liquid, but should not touch the bottom of the pail. If kerosene is used for cleansing, it should be removed by shaking the brush and rinsing it in turpentine before using again with paint. Brushes used with whitewash or calcimine should simply be washed and not put in the same liquids in which the brushes used for oil paints are kept. If a brush has been used for shellac varnish it should be kept in alcohol or in the varnish itself. In general a varnish brush may be kept in the varnish in which it is used.

Drying of Paints.—Water paints, such as whitewash and calcimine, dry in the ordinary sense; that is, by evaporation of the liquid, which in the case of the two paints mentioned is water. The drying of oil paints, however, is quite different, and in order to understand this attention must be drawn to certain peculiarities of the so-called drying oils. A thin coat of linseed oil will first become tacky and finally set to a hard, varnish-like film.

Oils which behave like linseed oil are called drying oils. The term "drying" as applied to oil is not similar to the drying which takes place on the exposure of a material wet with water to the dry air. The drying of a substance wet with water is really the removal of the water by evaporation. The drying of a drying oil is a change taking place in the liquid. This change is accompanied by an absorption of oxygen from the air, and the drying does

not take place in the absence of oxygen. It is hindered by moisture and hastened by sunlight.

The formation of this varnish-like film by the so-called drying of linseed oil is an exceedingly important operation in the drying of oil paints. Certain substances, compounds of lead and manganese, if dissolved in the oil, hasten drying. Boiled oil which contains compounds of lead or manganese, or both, will dry more rapidly than raw linseed oil. Instead of using boiled oil, however, the drying of the oil in paints is generally hastened by the addition of liquids known as driers. These liquids are composed of compounds of lead and manganese generally thinned with either turpentine or benzin, and are known as japan or japan driers. As before stated, while the use of a drier is necessary in a great many paints, the amount used should be small. It is a rather astonishing fact that many driers, if used in small proportions, will very materially hasten the drying of the linseed oil; whereas if a large amount of drier is added, the drying of the oil is retarded. There is another objection to the use of a large amount of drier, and that is that the film produced is not so durable as one produced by raw linseed oil alone or by the use of a raw oil containing the proper amount of drier. There are a number of other oils which have the property of drying like linseed oil, but none of them is the equal of linseed oil for a paint vehicle.

Bearing in mind these facts, it is seen that an oil paint would consist of the pigment mixed with a drying oil, preferably linseed oil, and generally with the addition of a drier. Some pigments, however, have the property of hastening the drying of linseed oil, and when they are used (red lead, for example) it is unnecessary to add any other drier. The varnish-like film left by linseed oil is for practical purposes insoluble in water. It is not, however, impervious to water. If a bright piece of iron covered with a coating of linseed oil, and afterwards thoroughly dried, is exposed to moisture it will be found that, while the iron will not rust so fast as uncoated iron, the rusting will take place to a considerable extent. Other experiments can be performed which will demonstrate that moisture passes through this film with comparative ease. But, if an oil paint is employed—that is, a mixture of pigment and linseed oil—it will be found that the water does not penetrate through the paint film. Also the paint film is more resistant to mechanical abrasion. While there is some difference of opinion among experts as to the amount of pigment which should be used in a paint, it is generally considered that the greater the amount of pigment the more resistant the paint film is, provided all the particles of pigment are thoroughly covered with the oil. It would appear, therefore, that a film of oil, while it may seem to be homogeneous even if examined under a high-power microscope, is really porous, and by mixture of the oil with the pigment the pores are more or less completely filled, thus making a more impervious film.

In addition to the linseed oil and drier, paints frequently contain volatile substances, such as turpentine and benzin. The addition of these is largely for the purpose of thinning the paint to a better working consistency, so that it can be spread in thin layers more easily. These volatile substances evaporate almost completely and do not remain behind in the dried film. The only

substance remaining which binds the solid particles of the pigment together is the oil.

Preparation of Surfaces for Painting.—All surfaces should be clean and as dry as possible before the application of an oil paint. Some new wood is very difficult to paint. The resins in such wood as yellow pine and spruce tend to destroy any paint that is laid over them. When possible, it is well to allow a new house to stand unpainted for at least six months or even a year after the woodwork has been completed. By this exposure to the weather the resins are brought to the surface and are either washed away or hardened, and the resulting wood surface is in much better condition for painting than is a new structure. An unpainted house, however, is an unsightly object, and it is often desired to paint a new house at once. Painters adopt several methods of treating new wood; probably the one most universally used is to coat all knots and other places where resin appears with shellac varnish, a solution of gum shellac in alcohol. Another plan is to mix with the priming coat of paint a small amount of benzol (coal-tar naphtha), which is claimed by some excellent authorities on painting to dissolve the surface layer of resins and allow the paint pigment to penetrate into the fibers of the wood, preventing the final forcing of the resins to the surface. After applying the priming coat, all nail holes and cracks should be well filled with putty pressed in hard. Filling in with putty should not be attempted before the priming coat is applied, as it is not likely to stick as well.

In painting iron surfaces all rust and grease should be carefully removed, scraping the surface down to bright metal with wire brushes or sandpaper and finally dusting off all adhering particles.

Painting should be done in dry weather. It is much better to select the summer time for painting than the winter. Not only does the paint not flow so well in cold weather, but the surfaces of the painted objects are more likely to be moist, and a little moisture underneath the paint film, either on wood or iron, is very apt to cause serious trouble.

Painting Exterior Woodwork.—All wood is more or less porous, and the natural result of applying a substance like paint to such a material is that the liquid portion sinks into the wood and leaves a large portion of the solid material on the surface. Also different parts of the wood will differ in porosity, and there will tend to be different amounts of paint left on different portions of the surface. In order to do a good job of painting on new wood it is practically always necessary to apply several coats. The first or priming coat is made thinner than the others, the amount of thinning depending upon the porosity of the wood. For ordinary pine, a paint of proper spreading consistency, when mixed with an equal volume of raw linseed oil, generally furnishes a good material for priming. With very porous wood, such as redwood, more oil may be added. The priming coat should be applied with as much care as any other and should be thoroughly brushed into the wood, the brushing being carefully done so that the paint is evenly distributed, with no tendency to run. It is the custom of many painters to add a great deal of drier and of turpentine to the priming coat, and to apply the other coats almost immediately after finishing the priming. This is not good practice. The paint for priming should consist of the pigment, linseed oil, and

a minimum amount of drier, with no turpentine or benzin; and after applying it at least a week and preferably longer should elapse before putting on the second coat.

Three coats at least are generally necessary to make a good piece of work. The effect of the priming coat, if properly applied, is to fill the pores of the wood and furnish a foundation on which to apply the subsequent coats. Owing to the different porosity of different parts of the surface, it is almost impossible to fill completely with one priming coat, and an attempt to get a good effect by applying the finishing coat immediately on top of the priming generally results in failure. A second coat will not penetrate to any very great extent into the wood. It should not, however, dry with a gloss, because a glossy surface does not furnish a good foundation for the next coat. In order to prevent the gloss, most painters add turpentine to the paint for the second coat; the amount used, however, should be small—to each gallon of paint about a half pint of turpentine in hot weather, or a pint in cold weather, is sufficient. The second coat, which of course should have been evenly spread and well rubbed in with the brush, should be allowed to dry somewhat longer than the priming coat. The third, or finish coat should be one which will dry with a gloss, and for this purpose there should be no turpentine or thinner added to the paint. This method is one which is advocated by a large majority of authorities on the painting of wood, but is seldom carried out by painters. The tendency is to add an excessive amount of turpentine or benzine, unduly thinning the paint and making it possible to spread it in thin, even coats with less labor than would be required for the same thinness and evenness when paint of a proper consistency is used.

Interior Painting.—For oil painting exposed to the weather (outside painting) it is very important that a durable paint be selected, because even the best painted surfaces in time are destroyed by outdoor exposure. Inside of a house, however, the conditions are radically different. The painted surface is exposed to neither the extreme heat of the summer sun nor to the action of rain and frost to anything like the extent that outdoor painting is. In fact, any paint will last much longer on the inside. The main point in selecting a paint for this work is to choose one which will cover well the article to be painted and which contains colors that are permanent. The actual protective coating may be assumed to last as long as there is any necessity for it. Very light tints or very brilliant colors are likely to fade, and white paints containing a large amount of oil tend to turn yellow in dark rooms. The pigment lithopone, which is not suitable for outside work, can be used with satisfaction for interior painting. Calcimine, the so-called cold-water paints, in which no oil or expensive lead or zinc pigments are used, and which are, therefore, very much cheaper than oil paints, last very well on the inside; in fact, some of the oldest paintings in existence are fresco paintings made practically of calcimine.

For interior work the same directions apply as to outside painting, but it is not so important to have the final coating contain such a large amount of oil as to give a glossy finish. A dull finish is preferred by many people, and since this paint is not to be exposed to severe weather conditions, a larger amount of thinner may be used than for outside work. Also, paint

for inside work should dry faster than one for the outside, and a somewhat larger amount of japan drier is generally used.

Painting of Metal.—Tin or other metal roofing, also galvanized iron, such as gutters and down spouts, are very difficult to paint, as often the paint does not stick well. This is probably due to a very thin film of grease left on such material from the process of manufacture, and before attempting to paint a tin roof it is best to scrub it perfectly clean with soap and water or with cloths moistened with benzine, and then thoroughly dry before applying the paint. Galvanized iron may be treated in the same way, but it is much better to let this material stand for some time exposed to the weather before painting. Cast iron is not so liable to rust as steel. Before painting such material the greatest care should be taken to get the surface perfectly clean. Do not apply paint over rust, but clean thoroughly down to the bare metal with scrapers or wire brushes, and finally with dry scrubbing brushes. It is a mistake to spare labor in preparing a metal surface for paint. All oil and grease should be scrupulously removed, and the metal surface should be absolutely clean and dry before painting. The paint should be well brushed on, carefully filling all cracks.

Two or three coats of any good paint may be used. The paint which is generally supposed to protect iron from rusting better than any other is red lead. The addition of a small amount of lampblack improves the color and the working quality of red-lead paint. A paint made of basic chromate of lead (so-called scarlet lead chromate, or American vermilion) is even better than red lead as a material for protecting iron.

Mixing Paints.—Paints may be prepared either by mixing the dry pigments with oil and turpentine or benzin; or the paste pigments may be used. The latter are ground in a small amount of vehicle, generally linseed oil. The best pigments are exceedingly fine powders, and it is frequently a matter of considerable difficulty to mix such a powder uniformly with oil so as to have every particle in contact with the vehicle. On this account it is generally considered much easier to make up a paint from the paste pigments than from the dry, because the former have already been ground in a small amount of oil in a mill. When a can of paste pigment is opened, all of it should be used immediately or it should be mixed with some oil and kept covered, since the paste is likely to harden and will then be ruined.

Besides the method of making up paints from the pigments, either dry or in paste form, with the necessary vehicle, the use of ready-mixed paints is very common, and for a small job they have an advantage, for no paint can be made properly without a large amount of grinding or stirring, and this is rather heavy work. The user of mixed paints, however, should have some method of estimating what the material he buys is really worth.

Composition of Paints.—It would probably not be denied by anyone that a better paint can be made in a well-equipped factory than by an individual at home or in a small shop. Many ready-mixed paints are of the very best quality, but many are of poor quality, made of cheap materials, and at the same time are sold with extravagant claims and for high prices. The number of different formulae found on the market is enormous, and no attempt will be made to give a complete or even a representative list of them. An effort

will be made, however, to give a few typical formulae of paints and the methods of calculating the cost of making paints whose composition is known. A very good rule to follow in purchasing mixed paints is to buy nothing which does not bear the name of the manufacturer. If the manufacturer's name does not appear on the label this is very good presumptive evidence that he is not particularly proud of his product. Many State laws require that the composition of paints should also be stated on the labels, and a large number of the best manufacturers do this whether their products are sold in a State requiring such labeling or not.

The most expensive paints are generally white paints or very light tints. The reason for this is that there are comparatively few white pigments which have covering power, *i.e.*, the property of hiding the surface of the material painted. Samples of dry white lead and of dry whiting look much alike. Both are white powders and a thin layer of each appears to be practically opaque. If, however, the two pigments are mixed in oil the whiting is quite transparent, while the white lead is opaque. All of the cheaper white pigments are more or less transparent in oil and are, therefore, deficient in covering power. White lead, zinc white, sublimed white lead, zinc lead, and lithopone are practically the only white pigments which have good covering power in oil. These pigments are all rather expensive, and as they are heavy it takes quite a large amount to make a paint.

Of the dark shades, there are a number of cheaper pigments which have very good covering power. It may be quite safely stated that, for a white paint that really covers, some one or more of the white pigments just enumerated must be used. For a dark brown, however, a good covering can be obtained with an iron oxide pigment, which is very much cheaper. Therefore, for such paints there is no reason for using an expensive lead or zinc pigment.

Composition of White Paints.—A vehicle for outside paint of the best quality will generally consist of from 90 to 95 per cent of linseed oil and from 10 to 5 per cent of japan drier. A good japan drier has about the same specific gravity as linseed oil, and each may be considered to weigh about 7¾ lb. to the gallon. In making up paints, the drier should be mixed with the larger portion of the oil before adding the pigment. A gallon of white lead paint will weigh from 21 to 22 lb. Fourteen pounds of dry white lead and 7¼ lb. of vehicle will make a gallon of paint. Fifteen pounds of paste lead and 6¼ lb. of vehicle will make a gallon of paint. Nine and one-half lb. of white zinc and 5¾ lb. of the paint will make a gallon of zinc white paint.

Many painters insist that a paint composed entirely of white lead, linseed oil, and drier is the best. Others contend that a mixture of white lead and zinc white is the best, and still others say that a mixture of these pigments with the cheaper white pigments which have slight covering power makes a better paint than the expensive pigments alone. It is probably true that a mixture of lead and zinc is superior to either pigment by itself, and also that the addition of a small amount of so-called inert pigments (silica, whiting, barytes, china-clay, etc.) has no injurious effect on the paint and may even be beneficial. The addition of a large amount, however, of such pigments will give a paint deficient in covering power, and the addition should have the

effect of cheapening the product. There is no reason why any mixed paint should cost per gallon more than a paint made entirely of white lead, oil, and the necessary drier. By ascertaining the market price of white lead and linseed oil the buyer should be able to calculate the maximum price for a mixed paint.

Colored Paints.—Tinted paints, at least those of light tint, consist practically of white paint with the addition of a small amount of coloring matter. The coloring materials used in tinting are not uniform, and it is not possible, therefore, to give exact directions for producing a particular shade, since the amount of color used will depend upon the individual characteristics of the particular lot on hand. In general, gray tints are made from white paints by the addition of a black pigment, such as lampblack or bone black, and sometimes a small amount of red or blue is used also. The total amount of coloring matter employed varies, but rarely amounts to as much as 5 per cent. Buff may be made by the addition of mixtures of ocher and umber; brown, by the addition of mixtures of black, red, and sometimes yellow. Yellow and cream may be made by the addition of ocher or chrome yellow; frequently for this purpose golden ocher is used, which is ordinary ocher brightened by the addition of a small amount of chrome yellow. Blue tints may be made by the addition of small amounts of Prussian blue. This is a powerful tinting pigment, and it is seldom that more than 1 per cent is required. With the white paints which contain no lead, ultramarine blue may be used instead of prussian blue; but ultramarine blue should not be used with lead paints.

Besides the tinted white paints, bright colors are sometimes desired, especially green for blinds and reds for the trimmings. These paints seldom contain any large amount of the expensive lead and zinc white pigments, but consist of comparatively small quantities of coloring matter and large amounts of the cheap white pigments. For black paints there is practically only one coloring substance, namely, carbon, which, however, occurs commercially in a number of forms. The color of so-called drop or ivory black is carbon, obtained from charred bone; lampblack is carbon in the form of soot. The latter, although very pure, does not make a satisfactory black alone, the heavier forms of carbon, such as bone black or even ground charcoal, producing a better black.

In the following table is given the composition of several tinted paints, and also of bright red, bright green, and black. The composition of individual lots of paint of any of these tints or colors might vary considerably from that given, and the table is only illustrative of the materials from which these different kinds of paints may be made.

COMPOSITION OF TINTED AND COLORED PAINTS

Data	Tints						Colored paints		
	Gray	Buff	Yellow	Drab	Blue	Brown	Red	Green	Black
Percentage composition:									
Vehicle	43.4	43.0	45.0	41.0	43.0	49.0	57.0	34.0	65.0
White lead	....	....	13.0	....	....	12.0			
Zinc white	21.0	21.0	25.0	21.0	22.0	24.0	2.0		
Sublimed white lead	27.0	29.0	....	26.0	27.0				
Barium sulphate	2.0	....	5.0	2.0	2.0	5.0	25.0	49.0	
China-clay	5.0	....	....	4.0	4.0				
Whiting	....	....	....	....	....	....	11.0		
Ground slate	....	....	....	....	....	....	....	....	26.0
Asbestine	1.0	1.0	1.0	1.0	1.0	1.0			
Color	0.6	6.0	11.0	5.0	1.0	9.0	5.0	17.0	9.0
Total pigment	56.6	57.0	55.0	59.0	57.0	51.0	43.0	66.0	35.0
Nature of color	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Weight in pounds per gallon:									
Total	14.7	14.8	14.1	15.2	14.8	13.4	11.6	16.4	10.0
Pigment	8.32	8.44	7.76	8.97	8.44	6.83	4.99	10.82	3.50
Vehicle	6.38	6.36	6.34	6.23	6.36	6.57	6.61	5.58	6.50

1. Bone black; tuscan red; ultramarine blue.
2. Umber and ocher.
3. Golden ocher.
4. Ocher and bone black
5. Prussian blue.
6. Bone black; venetian red; chrome yellow.
7. Para-red.
8. Five-sixths chrome yellow, one-sixth Prussian blue.
9. Carbon.

For dark shades of brown or red there is probably nothing which is as cheap as the oxide of iron pigments. These vary much in shade, giving both browns and dull reds. A pigment that gives a very satisfactory reddish-brown and contains about 40 per cent of iron oxide makes a satisfactory paint containing approximately 56 per cent pigment and 44 per cent vehicle, the vehicle being very much the same as that used in a first-class white paint. Such a paint will weigh about 13.5 lb. to the gallon, which, therefore, will contain 7.56 lb. of pigment and 5.94 lb. of vehicle.

Precautions to Be Observed in Painting.—Do not use any paints containing compounds of lead about stables or outbuildings where the fumes from decaying organic matter occur, since these gases are likely to darken the lead paints. Do not use with lead compounds any pigments which may liberate compounds of sulphur. For example, ultramarine blue which contains sulphur in a form in which it may be set free is a beautiful and very permanent blue and may be used with zinc white, but should not be used with white lead or any other lead pigments. Prussian blue, on the contrary, does not contain sulphur and may be used with lead pigments.

Many pigments are poisonous, and the workman should be particularly careful to remove all paint stains from the skin, and not under any circum-

stances allow any of it to get into his mouth. A man should not eat in the same clothes in which he has been painting, and before eating should not only change his clothes but wash all paint stains from his skin. It is not advisable to use turpentine or benzin in removing paint stains from the hands, but by oiling thoroughly with linseed oil, or, in fact, with any fatty oil, and then thoroughly washing with soap, the paint may be removed, provided it has not been allowed to dry too thoroughly on the hands.

Estimating Painting.—In estimating painting the modern unit for taking off quantities is 100 sq. ft. Formerly the square yard was used exclusively but is now gradually being superseded.

All items varying in cost of labor or material should be taken off separately, such as enameled walls, picture mold, etc. In taking off quantities, actual areas are taken, except windows, grills, balusters, etc., which are figured solid. The cost of painting windows, with small lights, ornamental balusters and similar work, very often exceeds the cost of flat work of the same area, so that the estimator must use his judgment in applying the flat rate, and add a percentage for the extra work involved. Picture mold, chair rail and baseboard must be taken off in units of 100 lin. ft.

The governing factors are labor and material, but in addition to these the following must be considered and provided for in the estimate:

Location of job, transportation of labor and material.
Location of work, scaffolding, staging, etc.
Preparation of surface to be painted, puttying, sizing, sandpapering or removal of old paint or paper.
Overhead for plant.

Transportation of labor and material need be considered only where the job is located at some remote point, and is governed by local transportation charges.

Scaffolding on the average job is a minor item, consisting mainly of the labor necessary for erection and a charge for use of the scaffold. Staging on large work, such as auditoriums, involves considerable labor and material, and this item should be figured separately. On new work requiring extensive staging, arrangements can sometimes be made with the plaster contractor to use the same facilities.

Labor to Apply Paint.—The data on labor hours required to apply paint, as given in the table, were obtained from practical painters who keep cost records on their work. The time given is only for applying

paint and does not include the time required to mix paint or other preparatory work.

PAINTING
(Labor and material)

Surface	Kind of coat	Number coats	Unit of work	Amount of material		Hours per unit
				Gallons	Pounds	
Plastered walls and ceilings	Varnish size	1	100 S.F.	0.29	....	0.56
Plastered walls and ceilings	Lead and oil	2	100 S.F.	0.64	....	1.57
Plastered walls and ceilings	Glue size	1	100 S.F.	....	0.15	0.34
Plastered walls and ceilings	Kalsomine	1	100 S.F.	....	4.88	0.73
Plastered walls and ceilings	Whitewash	2	100 S.F.	....	4.33	0.90
Brick walls	Whitewash	2	100 S.F.	....	6.67	1.00
Brick walls	Cold water paint	2	100 S.F.	....	9.33	0.92
Brick walls	Lead and oil	2	100 S.F.	1.26	....	1.49
Floors—wood	Linseed oil	2	100 S.F.	0.46	....	0.94
Floors—wood	Filler	1	100 S.F.	....	2.36	1.00
Floors—wood	Varnish	2	100 S.F.	0.52	....	1.50
Interior woodwork	Filler	1	100 S.F.	....	2.36	1.27
Interior woodwork	Shellac and putty	1	100 S.F.	0.44	....	0.90
Interior woodwork	Varnish	2	100 S.F.	0.51	....	2.24
Interior woodwork	Rub—oil and pumice	..	100 S.F.	0.24	....	2.00
Interior woodwork	Lead and oil	3	100 S.F.	0.91	....	3.04
Exterior woodwork	Stain and putty	1	100 S.F.	0.22	....	0.83
Exterior woodwork	Varnish	2	100 S.F.	0.53	....	1.93
Exterior woodwork	Lead and oil	3	100 S.F.	0.93	....	2.85
Single door with transom	Filler	1	Each	....	1.50	1.50
Single door with transom	Shellac and putty	1	Each	0.21	....	1.06
Single door with transom	Sandpaper and varnish	2	Each	0.50	....	1.90
Single door with transom	Rub—oil and pumice	..	Each	0.10	....	1.75
Single door without transom	Filler	1	Each	....	1.50	1.24
Single door without transom	Shellac and putty	1	Each	0.18	....	0.86
Single door without transom	Sandpaper and varnish	2	Each	0.36	....	1.59
Single door without transom	Rub—oil and pumice	..	Each	0.09	....	1.24
Single window	Filler	1	Each	....	0.50	0.52
Single window	Shellac and putty	1	Each	0.11	....	0.48
Single window	Sandpaper and varnish	2	Each	0.21	....	0.80
Single window	Rub—oil and pumice	..	Each	0.05	....	0.85
Single window	Lead and oil	3	Each	0.29	....	1.33
Shingles	Stain, dipped ⅔	1	M	1.00	....	0.92
Picture mold or chair rail	Filler	1	100 L.F.	....	1.72	1.75
Picture mold or chair rail	Varnish	2	100 L.F.	0.25	....	
Base board	Filler	1	100 L.F.	....	2.00	3.75
Base board	Varnish	2	100 L.F.	0.67		
Base board	Lead and oil	3	100 L.F.	0.67	....	3.70
Picture mold or chair rail	Lead and oil	3	100 L.F.	0.27	....	1.75
Iron stairs and railing	Lead and oil	3	Flight	2.33	....	11.25
Gutters and leaders	Lead and oil	..	100 L.F.	1.36	....	4.00
Sheet metal roofs	.....	..	100 S.F.	1.30	....	0.87

Cost of Paints.—The average cost of paint, per gallon, by the barrel, is $2.85 for tinted paint, and $2.95 for red, green, black, and white. Turpentine and linseed oil average $1 per gallon.

FINISHING WOOD FLOORS

The following is recommended by the Maple Flooring Manufacturers' Association:

Formula for Wax Finishing Beech and Birch.—Natural Finish: First, fill with wood alcohol and light colored umber mixed to the consistency of thick cream, and rub thoroughly into the wood. Never use benzine, which evaporates and may discolor. Wood alcohol, originally from the wood itself, penetrates hardwoods. Second, apply two coats of alcohol shellac and rub each coat well when dry. Third, apply one coat of linseed oil and pumice stone and rub well. Fourth, apply one coat of equal portions of wood alcohol and turpentine mixed and rub well. Fifth, apply three or four coats of light colored floor wax, rubbing each coat thoroughly before applying the next. If an even-colored finish is desired put a little cherry stain in the filler.

Special White Finish for enameled bedrooms and bathrooms: First, fill with wood alcohol and best quality white lead and rub thoroughly into the wood. Second, treat same as above.

Formula for Wax Finishing Maple.—Natural Finish—White Clear: First, fill with umber and best quality white lead thinned with wood alcohol mixing to the consistency of thick cream, and rub thoroughly into wood. Second, apply two coats of alcohol shellac and rub well. Third, apply one coat of linseed oil and pumice stone and rub well. Fourth, apply one coat of equal portions of wood alcohol and turpentine mixed and rub well. Fifth, apply three or four coats of light colored floor wax, rubbing each coat thoroughly before applying the next.

Clear: Finish same as White Clear, unless an even color is desired; then mix a little gray umber in the filler.

Staining Maple, Beech and Birch.—The most successful process for staining maple consists in using a filler of wood alcohol and best quality white lead, stains going in with this filler. Rub thoroughly into the wood.

Follow this process for beach and birch, which take stains admirably, but a thin, transparent stain should be used that will color the wood without obliterating its character. Try out on small surface, to see that you have gained the right color.

Applying Stains Direct to the Wood.—Oil stains are recommended when a stain is to be applied direct to the wood. Oil stains do not set quickly and give the operator longer time in which to work. The color should be worked into the wood and not allowed to remain on the surface. Rub off to an even tone before the stain hardens.

Varnished Floors.—A satisfactory method of varnishing maple, beech, or birch floors is to thin the varnish by adding turpentine, the quantity to be added varying from 10 to 30 per cent, and applying the varnish thus prepared directly to the wood.

When dry and hard, sandpaper lightly with No. 00 sandpaper to remove the small air blisters; wipe clean and give a coat of full body varnish just as it comes from the can. A third coat should be given in the same way and rubbed down with pulverized pumice stone and rubbing oil. Then the floor should be wiped dry and clean, removing the oil.

Varnish does not dry so well at night, with or without artificial light, as in the daytime. Ventilation, temperature, and light are important.

Windows should be open to insure ventilation.

Important: Do not use liquid fillers or shellac under varnish. The floor must be dry and clean before a drop of finishing material is placed on it. Temperature should be between 70 and 80°.

Portions of varnished floors subjected to excessive wear may be renewed if the work is undertaken before the wood is exposed and turns dark.

Such portions should be cleaned with white soap and water and a thin coat of varnish applied. This should be rubbed well, then coated with full body varnish and rubbed down to correspond with the remainder of the floor.

Service Floor Finishing.—It is a good investment to give the industrial — or service—floor a hot oil treatment when laid. The most efficient way is by dipping the flooring strips in raw linseed oil, heated as nearly as possible to the boiling point. This is generally done by the installation of a large tank on the grounds and any competent flooring contractor can do this. A good grade of linseed oil should be used. Three or four days should be allowed for thorough absorption of the oil. The usual treatment, however, consists in coating the floor, immediately after it has been laid, with raw linseed oil, the oil being heated as nearly as possible to the boiling point and applied with a mop while hot.

Commercial preparations for floors in public buildings, factories, office buildings, churches, stores, etc., are frequently used instead of this hot oil treatment.

There are several such preparations on the market which are easily applied to the newly laid floor and the Association will furnish manufacturers' names upon request.

Keeping Hardwood Floors in Good Condition.—The amount of attention required to keep a hardwood floor in order depends wholly upon the use it is subjected to. All floors should be gone over from time to time and touched up.

In the regular course of cleaning, remove the dust by pinning a damp soft cloth over an ordinary broom so that the dust will adhere to it more readily, but be sure to wipe dry with a dry cloth immediately afterwards. In case some dirt should adhere to the floor, that the damp cloth will not remove, use some lukewarm water and soap, being particular to cleanse this off as quickly as possible and wipe dry. For removing stains, use a cloth saturated with turpentine or benzine.

If the finish is dull after giving it a thorough cleansing as recommended above, obtain, at a small cost, some floor reviver, saturate a cloth with it, wring it out half dry and rub the finish until the luster returns.

CHAPTER XIX

GLASS AND GLAZING

Ordinary Window Glass, Quality.—There are three grades of common window glass, *AA*, *A* and *B*. The quality known as *AA* is a clear glass, free from any perceptible amount of blisters or air bubbles, burns or burned specks, cords or strings. It has a good gloss and an even well-flattened surface.

A glass is the glass generally used when no special grade is specified and it admits of such defects as small strings or lines, small blisters when not too close to one another or when located in the center of the sheet. It is well flattened with an even surface and devoid of noticeable scratches, cropper marks, burns and other prominent defects.

B glass covers a wider range than either *AA* or *A* quality. It permits many of the defects inherent in the process of making, such as waves, strings, lines, blisters, scratches, burns and other similar or equivalent defects. This quality embraces everything below *A* quality.

Crystal Sheet Glass.—This is a heavy blown glass, made by the same process as ordinary window glass and subject to the same inherent defects. It is graded in *AA*, *A* and *B* quality and made in various thicknesses: 26-oz., 29-oz., 34-oz. and 39-oz. ($\frac{3}{16}$ in. thick).

Glass is usually sold by list and discount. The lists very seldom change, while the discounts vary from time to time and it is possible of course to get better discounts on large orders than on small ones. Fractional sizes always take the price of the next size larger in the list.

Thickness and Weight.—Single strength measures approximately 12 lights to the inch but a small variation either way is permissible. It weighs about 16 oz. to the square foot. Double strength measures approximately 9 lights to the inch. The thickness should be fairly uniform and the weight about 24 oz. to the square foot.

Boxing of Window Glass.—Window glass is packed in regular sizes with approximately 50 sq. ft. to the box up to the 100 united-inch

bracket (adding width and length), and 100 sq. ft. to the box in sizes over 100 united inches.

Shipping Weights.—Single strength in factory packages weighs from 65 to 75 lb. per box. Double strength in factory packages of 50 sq. ft. weighs from 85 to 110 lb. per box. Double strength in 100-ft. cases weighs approximately 225 lb. The sizes for glass are usually expressed in inches. The width should always be given first and then the height.

The following tables of list prices cover only a small portion of the manufacturer's lists, but give enough so that almost any size required can be estimated. The discounts given are only approximate and should be checked by getting the current discount at the time and place for which the price is required:

Window Glass List Prices

(Discount 83 per cent)

Single					Single				
Size	*AA*	*A*	*B*	Number lights per box	Size	*AA*	*A*	*B*	Number lights per box
6 by 8	$0.30	$0.25	$0.24	150	16 by 16	$ 1.63	$ 1.39	$ 1.34	28
7 by 9	0.39	0.33	0.32	114	20	2.12	1.80	1.69	23
8 by 10	0.49	0.42	0.40	90	30	3.55	3.09	2.88	15
12	0.59	0.50	0.48	75	48	6.67	6.05	5.42	9
14	0.69	0.59	0.56	64	18 by 18	2.22	1.88	1.77	22
20	1.02	0.87	0.83	45	36	5.00	4.32	3.98	11
9 by 12	0.66	0.56	0.54	67	48	7.50	6.80	6.10	8
10 by 12	0.73	0.62	0.60	60	20 by 20	2.96	2.58	2.40	18
14	0.86	0.73	0.70	51	36	5.63	5.00	4.50	10
16	1.02	0.87	0.84	45	52	9.65	8.84	7.77	7
11 by 12	0.80	0.68	0.65	55	22 by 22	3.55	3.09	2.88	15
16	1.12	0.95	0.92	41	36	6.25	5.56	5.00	9
20	1.39	1.18	1.14	33	52	11.25	10.32	9.07	6
24	1.81	1.53	1.44	27	24 by 24	4.43	3.86	3.59	12
36	2.96	2.58	2.40	18	36	7.04	6.25	5.63	8
50	4.62	4.19	3.75	13	56	14.25	13.13	11.75	5
12 by 12	0.88	0.75	0.72	50	26 by 26	5.00	4.32	3.98	11
16	1.21	1.02	0.99	38	36	7.50	6.80	6.10	8
20	1.53	1.30	1.25	30	52	13.50	12.33	10.33	5
24	1.95	1.65	1.55	25	28 by 28	6.25	5.56	5.00	9
36	3.13	2.73	2.54	17	40	10.00	9.07	8.13	6
60	7.13	6.57	5.88	60	54	14.25	13.13	11.75	5
13 by 16	1.31	1.11	1.08	35	30 by 30	7.50	6.80	6.10	8
24	2.12	1.80	1.69	23	42	11.25	10.32	9.07	6
50	5.47	4.95	4.44	11	54	17.82	16.41	14.69	4
14 by 14	1.24	1.05	1.02	37	32 by 32	8.58	7.77	6.97	7
20	1.76	1.50	1.45	26	42	13.50	12.38	10.88	5
30	3.13	2.73	2.54	17	52	17.82	16.41	14.69	4
60	7.92	7.30	6.53	9	34 by 34	10.00	9.07	8.13	6
15 by 16	1.53	1.30	1.25	30	40	13.50	12.38	10.88	5
18	1.69	1.44	1.39	27	48	17.82	16.41	14.69	4
24	2.44	2.07	1.94	20	36 by 36	11.25	10.32	9.07	6
50	6.00	5.44	4.88	10	46	17.82	16.41	14.69	4

Window Glass List Prices

(Discount 85 per cent)

Size	Double AA	Double A	Double B	Number lights per box
6 by 8	$ 0.39	$ 0.34	$ 0.33	150
7 by 9	0.51	0.45	0.43	114
8 by 10	0.64	0.57	0.54	90
12	0.77	0.68	0.65	75
14	0.90	0.80	0.76	64
20	1.39	1.24	1.16	45
9 by 12	0.86	0.76	0.72	67
10 by 12	0.96	0.85	0.81	60
14	1.13	1.00	0.95	51
16	1.39	1.24	1.17	45
11 by 12	1.04	0.93	0.88	55
16	1.53	1.36	1.29	41
20	1.90	1.69	1.60	33
24	2.55	2.25	2.07	27
36	4.24	3.79	3.55	18
50	6.54	5.87	5.39	13
12 by 12	1.15	1.02	0.97	50
16	1.65	1.47	1.39	38
20	2.09	1.96	1.75	30
24	2.75	2.43	2.23	25
36	4.49	4.01	3.75	17
60	9.32	8.50	7.75	10
13 by 16	1.79	1.59	1.51	35
24	2.99	2.64	2.42	23
50	7.73	6.94	6.37	11
14 by 14	1.70	1.51	1.43	37
20	2.41	2.14	2.02	26
30	4.49	4.01	3.75	17
60	10.35	9.44	8.61	9
15 by 16	2.09	1.86	1.75	30
18	2.32	2.07	1.95	27
24	3.44	3.04	2.79	20
50	8.50	7.63	7.00	10
16 by 16	2.24	1.99	1.88	28
20	2.99	2.64	2.42	23
30	5.09	4.55	4.25	15
48	9.44	8.48	7.78	9
60	11.65	10.63	9.69	8
76	16.67	15.21	14.17	6
18 by 22	4.24	3.79	3.55	18
36	7.11	6.37	5.92	11
60	13.31	12.15	11.08	7
76	20.00	18.25	17.00	5
20 by 20	4.24	3.79	3.55	18
36	8.00	7.13	6.57	10
60	15.53	14.17	12.92	6
90	33.75	31.25	29.15	8
22 by 22	5.09	4.55	4.25	15
36	8.89	7.92	7.30	9
72	20.00	18.25	17.00	5
90	43.31	39.47	37.15	7
24 by 24	6.36	5.68	5.32	12
36	10.00	8.91	8.21	8
60	18.63	17.00	15.50	5
90	43.31	39.47	37.15	7

Size	Double AA	Double A	Double B	Number lights per box
26 by 26	$ 7.11	$ 6.37	$ 5.92	11
48	15.21	13.86	12.61	6
72	29.07	26.57	25.00	4
90	59.38	53.86	51.05	6
28 by 28	8.89	7.92	7.30	9
48	18.25	16.63	15.13	5
72	29.07	26.57	25.00	4
90	59.38	53.86	51.05	6
30 by 30	10.63	9.54	8.75	8
60	24.54	22.50	20.79	4
72	40.53	37.19	34.38	7
90	71.25	64.63	61.25	5
32 by 32	12.15	10.90	10.00	7
72	40.53	37.19	34.38	6
86	71.25	64.63	61.25	5
34 by 34	14.17	12.71	11.67	6
60	25.00	22.82	21.25	4
86	71.25	64.63	61.25	5
36 by 36	15.21	13.86	12.61	6
72	45.00	41.67	38.86	6
86	78.00	71.38	68.00	5
38 by 38	18.25	16.63	15.13	5
60	38.75	35.42	33.33	5
72	54.00	50.00	46.63	5
86	97.50	89.22	85.00	4
40 by 40	18.25	16.63	15.13	5
60	38.75	35.42	33.33	3
72	60.63	55.25	52.00	5
84	97.50	89.22	85.00	4
42 by 42	25.62	23.39	21.33	4
60	44.58	40.92	37.82	6
72	66.69	60.78	57.20	5
80	107.25	98.15	93.50	4
44 by 44	26.99	24.75	22.87	4
60	53.49	49.09	45.38	5
80	107.25	98.15	93.50	4
46 by 46	36.68	33.47	31.18	3
60	59.40	55.00	51.29	5
80	116.54	107.43	102.79	4
48 by 48	42.63	38.97	36.68	3
60	59.40	55.00	51.29	5
80	116.54	107.43	102.79	4
50 by 50	42.63	38.97	36.68	3
60	59.40	55.00	51.29	5
74	107.25	98.15	93.50	4
52 by 52	53.49	49.09	45.38	5
60	66.69	60.78	57.20	5
72	107.25	98.15	93.50	4
54 by 54	78.38	71.09	67.38	5
72	116.54	107.43	102.79	4
56 by 56	78.38	71.09	67.38	5
72	116.54	107.43	102.79	4
58 by 58	97.98	88.87	84.23	4
72	155.38	143.24	137.05	3
60 by 60	97.98	88.87	84.23	4
70	155.38	143.24	137.05	3

Glazing.—At the present time much of the small sized glass, when used in metal and in wood sash, is set at the factories, but as some glass is still set at the job, the following information will be useful.

An experienced glazer will set in metal sash about 90 lights of average size in a day of 8 hr. Metal sash requires a special putty, and takes about 1 lb. to the light. The present market price of this putty is 5 cts. per pound. In setting glass of an average size for interior partitions, doors, etc., a glazer will set 100 sq. ft. per day. When setting small lights in wood sash, a glazer will set about 135 lights per day, using approximately ½ lb. of putty per light. This includes lights up to 2 sq. ft.

Plate Glass.—Plate glass can be made in sizes up to 250 sq. ft., as, for example, 10 by 21 ft., 12 by 20 ft. or 13 by 19 ft. These extreme sizes, however, are difficult to make, expensive and dangerous to handle and clean. They are made only to order and require special flat-car shipment and special facilities for unloading and handling and can only be set by the most expert glazers.

Plate glass ranges from ⅛ to ½ in. in thickness. The standard product runs from ¼ to 5/16 in. full. Other thicknesses, whether over or under the standard, are special and cost more.

Weight of Plate Glass.—Plate glass in regular glazing thickness (¼ to 5/16 in. full) weighs about 3½ lb. per square foot, bare, and may be computed at approximately 5 lb. per square foot boxed for shipment. A rule for figuring shipping weight of plate glass is found in the official price-list which is as follows:

The weight of glass should be figured at 3½ lb. per square foot. The weight of the box equals the area of a plate of the greatest width and length of those packed therein, multiplied by ten. Thus:

1 plate, 36 by 96 in.	= 24 sq. ft.	@ 3½ lb.	=	84 lb.
1 plate, 60 by 84 in.	= 35 sq. ft.	@ 3½ lb.	=	122½ lb.
Size of box 60 by 96 in.	= 40 sq. ft.	@ 10 lb.	=	400 lb.
				600 lb.

Setting of Plate Glass.—Store fronts and work of a similar nature are now generally set in metal. When set in wood, with lights up to 6 by 8 ft. or with a surface not larger than 50 sq. ft., a gang of from three to four men is required. They should set one light in an hour and a half, making about 6 hr. of labor per light.

Cost of Plate Glass.—Plate glass is never sold by the square foot but at so much a piece. Quotations are made on list and discount. The list remains constant for many years while the discount changes from time to time.

The following tables do not give all sizes listed. If any size not given is required, it can be obtained by interpolation.

POLISHED PLATE GLASS LIST PRICES
(Discount 75 per cent)

Lengths, in.	Widths, in.					
	12	16	20	24	30	36
20	$ 5.85	$ 8.35	$ 11.10			
30	9.40	14.15	18.75	$22.50	$ 30.70	
36	12.00	17.00	22.50	29.40	37.20	$ 48.20
48	17.00	25.40	33.00	40.80	53.50	63.00
60	22.50	32.70	43.80	53.50	66.90	80.30
72	28.50	39.60	52.50	64.20	80.20	98.10
96	39.60	55.50	69.40	85.60	110.00	131.00
120	52.00	69.40	89.20	111.00	139.00	168.00
144	62.40	84.80	109.00	134.00	176.00	211.00
170	75.10	103.00	129.00	166.00	208.00	249.00

Lengths, in.	Widths, in.					
	42	48	54	60	72	78
48	$ 72.80	$ 85.60				
56	87.40	102.00	$115.00			
60	93.70	111.00	123.00	$139.00		
72	115.00	131.00	156.00	173.00	$207.00	
96	157.00	184.00	207.00	230.00	276.00	$312.00
108	177.00	202.00	227.00	252.00	324.00	351.00
120	196.00	224.00	252.00	280.00	360.00	390.00
144	246.00	281.00	335.00	372.00	447.00	484.00
180	407.00	465.00	524.00	582.00	698.00	756.00
218	493.00	564.00	634.00	704.00	845.00	916.00

Lengths, in.	Widths, in.					
	84	96	108	120	132	144
88	$ 308.00					
96	348.00	$ 397.00				
108	391.00	447.00	$ 486.00			
120	434.00	496.00	540.00	$ 775.00		
132	462.00	528.00	594.00	853.00	$1,150.00	
144	521.00	596.00	837.00	930.00	1,518.00	$1,728.00
168	760.00	868.00	1,197.00	1,610.00	2,156.00	3,192.00
180	814.00	930.00	1,553.00	1,800.00	3,135.00	3,420.00
200	905.00	1,534.00	1,800.00	3,167.00	3,667.00	4,000.00
218	1,209.00	1,744.00	3,107.00	3,634.00	3,997.00	

(Mirror Plates, Plain and Beveled, List Prices)
(Discount 88 per cent)

Length, in.	20 in. width				24 in. width				30 in. width			
	Plain	Size of bevel			Plain	Size of bevel			Plain	Size of bevel		
		1 in.	1¼ in.	1½ in.		1 in.	1¼ in.	1½ in.		1 in.	1¼ in.	1½ in.
36	$79.60	$88.85	$91.20	$93.50	$101.80	$111.80	$114.30	$116.80	$129.00	$139.00	$142.60	$145.30
48	113.15	124.40	127.20	130.10	137.60	149.50	152.50	155.40	188.00	201.30	204.60	207.90
60	143.30	158.20	161.90	165.70	172.00	187.00	190.80	194.50	263.75	285.00	290.30	295.70
72	172.00	189.90	194.40	198.80	225.60	249.50	255.50	261.40	316.50	341.40	347.60	353.80
96	281.30	400.10	429.80	459.50	337.60	456.40	486.10	515.80	422.00	540.90	570.60	600.30
120	351.80	.....	537.50	574.60	422.00	.....	607.70	644.80	544.80	.....	730.50	767.60
150	454.00	.....	687.00	733.60	544.80	.....	777.80	824.40	738.50	.....	971.70	1,018.30

Length, in.	36 in. width				48 in. width			60 in. width			72 in. width		
	Plain	Size of bevel			Plain	Size of bevel		Plain	Size of bevel		Plain	Size of bevel	
		1 in.	1¼ in.	1½ in.		1¼ in.	1½ in.		1½ in.	2 in.		1½ in.	2 in.
36	$154.80	$167.10	$170.10	$173.20									
48	225.60	244.10	248.80	253.40	$337.60	$407.50	$421.50						
60	316.50	337.90	343.20	348.60	422.00	497.70	512.80	$544.80	$645.80	$679.50			
72	379.80	441.10	456.40	471.70	523.00	605.50	622.00	709.00	824.80	863.40	$850.80	$1,029.00	$1,088.30
96	523.00	641.90	671.60	701.30	756.30	904.80	934.50	945.30	1,138.50	1,202.80	1,178.50	1,386.40	1,455.70
120	709.00	.....	894.70	931.80	945.30	1,131.00	1,168.10	1,227.60	1,450.40	1,524.60	1,556.00	1,793.70	1,872.90
150	886.20	.....	.....	1,165.90	1,227.60	.....	1,507.40	1,620.80	1,900.60	1,993.80	1,944.90	2,224.60	2,317.80

BEVELING PLATE GLASS LIST PRICES
(Discount 80 per cent)
Size of bevel

Combined Length and width, in.	½	¾	1	1¼	1½	1¾	2
12	$0.68	$0.80	$ 1.00	$ 1.24	$ 1.44	$ 1.68	$ 1.92
24	1.52	1.76	2.32	2.80	3.36	3.84	4.32
50	3.34	3.84	5.20	6.18	7.52	8.52	9.52
74	....	7.76	9.36	10.90	12.38	13.96	15.54
100	....	....	17.42	20.78	24.14	27.50	30.88
124	....	....	26.80	32.18	37.56	42.94	48.32
150	....	....	45.00	54.00	63.00	72.00	81.00
174	....	....	.....	114.64	133.68	152.72	171.76
200	....	....	.....	.....	271.00	308.00	345.00
250	....	....	.....	.....	1,020.00	1,050.00	1,080.00

For 2¼-in. bevel, add ⅛ to 2-in. list price
2½-in. bevel, add ¼ to 2-in. list price
2¾-in. bevel, add ⅜ to 2-in. list price
3 -in. bevel, add ½ to 2-in. list price

PLATE AND WINDOW GLASS LIST PRICES FOR BENDING, NOT EXCEEDING QUARTER CIRCLE
(Discount 25 per cent)
PLATE GLASS

	SQUARE FEET
Plates where length and width are added, less than 76 in.....	$0.60
Plates of—	
76 or more but less than 90 united in.....	0.75
90 or more but less than 100 united in.....	1.00
100 or more but less than 110 united in.....	1.50
110 or more but less than 120 united in.....	2.00
120 or more but less than 140 united in.....	2.50
140 or more but less than 160 united in.....	3.00
160 or more but less than 180 united in.....	3.50
180 or more but less than 200 united in.....	4.00
200 or more but less than 210 united in.....	4.50
210 or more but less than 220 united in.....	5.00
220 or more but less than 230 united in.....	5.50
230 or more but less than 240 united in.....	6.00

WINDOW GLASS

	Square Feet
Lights of less than 60 united in	$0.25
Lights of—	
60 or more but less than 70 united in	0.30
70 or more but less than 80 united in	0.40
80 or more but less than 90 united in	0.50
90 or more but less than 100 united in	0.60
100 or more but less than 110 united in	0.90

1. Larger sizes, irregular shapes, bends exceeding quarter circle, and rough and ornamental glass are charged at special prices.

2. Beveled glass is 25 per cent additional and at owner's risk.

3. Bending on the length where it exceeds the width by more than 6 in. is 25 per cent additional.

Wire Glass.—Wire glass is used in skylights, in metal sash windows and practically anywhere where glass with fire-resisting qualities is required.

Standard Thickness.—Wire glass is made in sheets as large as 60 in. wide and 130 in. long and in several thicknesses. The standard thickness for general use is ¼ in. Thinner wire glass is obtainable, 3/16 in. and ⅛ in. being made for special purposes, but the universal demand is for ¼ in., ⅜ in. or heavier. No wire glass less than ¼ in. thick is accepted under the rules of the Fire Prevention Bureaus of the National Board of Fire Underwriters.

Cost of Wire Glass.—The cost of wire glass, such as rough, ribbed, maze, etc., is approximately 30 cts., and polished wire glass which is transparent is $1.10 per square foot.

Figured Glass.—The cost of figured glass, such as Florentine, Syenite, Maze, etc., is 25 cts. per square foot. Prism glass costs approximately 30 cts. per square foot for the ordinary sheet prism glass but there are some types of prism glass made ornamentally and polished, which cost about $1.25 per square foot.

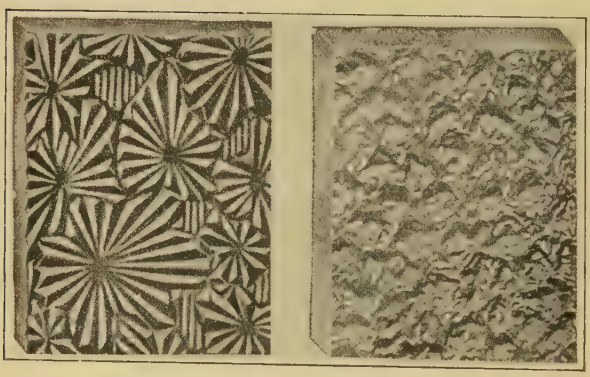
COBWEB GLASS

Sizes up to 54 in. by 120 in. Thicknesses ⅛ in. and 3/16 in. Sizes up to 60 in. by 120 in. Thicknesses ¼ in. and ⅜ in.

HOLLY GLASS

Sizes up to 48 in. wide and 132 in. long. Thicknesses ⅛ in., and 3/16 in.

Fig. 1.



FLORENTINE GLASS

SYENITE OR MOSS GLASS

Sizes up to 48 in. wide and 132 in. long. Thicknesses ⅛ in., and 3/16 in.

Fig. 2.

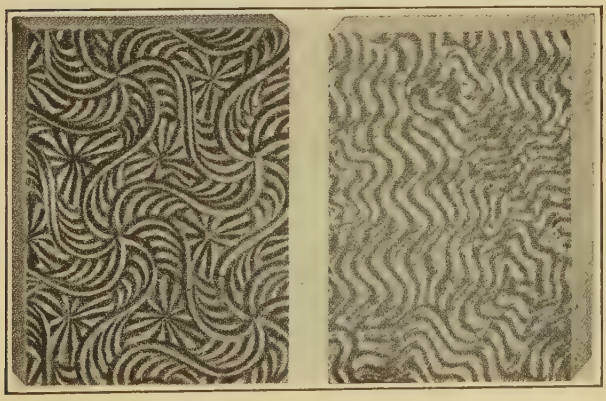
ROMANESQUE GLASS

Sizes up to 48 in. wide and 132 in. long for ⅛ in. thick and 60 in. wide and 132 in. long for 3/16 in. thick.

FIGURE NO. 2 GLASS

Sizes up to 42 in. wide and 110 in. long. Thicknesses 18 in. and 3/16 in.

FIG. 3.



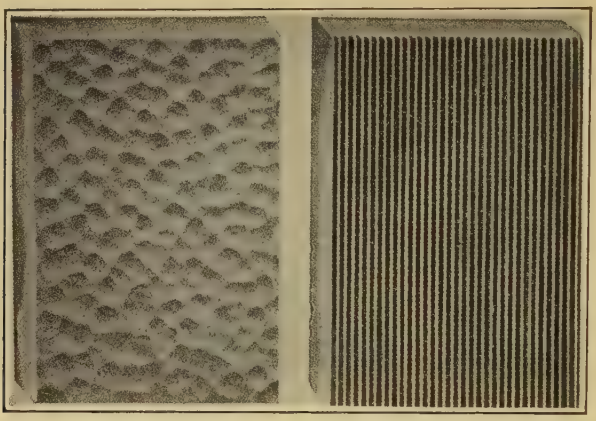
MAZE GLASS

Sizes up to 48 in. wide and 132 in. long. Thicknesses ⅛ in. and 3/16 in.

COLONIAL GLASS

Sizes up to 44 in. wide, 132 in. long. Thicknesses ⅛ in. and 3/16 in.

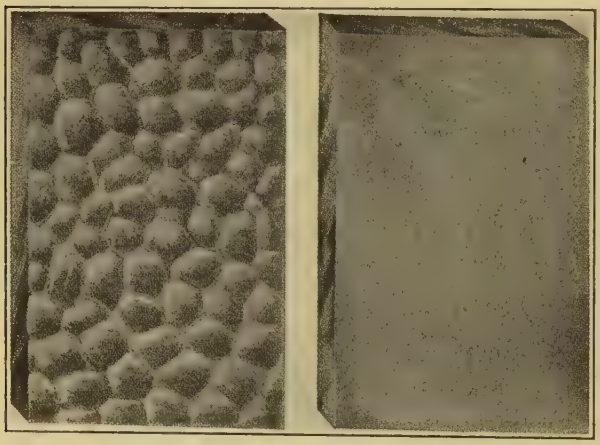
FIG. 4.



ROUGH GLASS RIBBED GLASS[1]

Sizes up to 48 in. wide and 132 in. long. Thicknesses ⅛ in., 3/16 in., ¼ in., ⅜ in. and ½ in.

FIG. 5.



HAMMERED CATHEDRAL SMOOTH CATHEDRAL

Size 30 in. wide, 90 in. long. Thickness correct for leading.

FIG. 6.

[1]The rib runs with the length of the sheet. In ordering always specify width first.

CHAPTER XX

MISCELLANEOUS IRON WORK

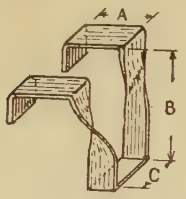
Ornamental and architectural iron work as applied to buildings is usually covered by special detailed drawings and specifications. This class of work consists mostly of hand-wrought iron and special castings and special estimates must be obtained from the subcontractors handling this work.

Iron work which does not require special patterns such as coal chute covers, beam hangers, etc. is usually carried in stock by the dealers or iron contractors or can be furnished on short notice from stock patterns. A limited number of these have been listed in the following pages to give the estimator a general idea as to their cost, but when large quantities are required it is advisable to get a special estimate from a subcontractor.

Ashlar Anchors—Per 100

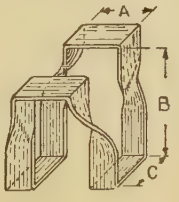
Section, inches	8 in.			10 in.			12 in.			14 in.			16 in.		
	Lb.	Plain	Galv.	Lb.	Plain	Galv.	Lb.	Plain	Galv.	Lb.	Plain	Galv.	Lb.	Plain	Galv.
¾ by ⅛	29.6	$3.54	$5.28	34.9	$4.05	$6.18	40.2	$4.71	$7.05	45.5	.....	.....	50.8		
1 by ⅛	39.4	3.87	6.18	46.5	4.59	6.87	53.6	5.28	7.59	60.6	.....	$8.34	67.7		
1 by 3/16	59.2	5.04	7.68	69.8	5.88	9.00	80.4	6.78	10.32	91.1	$7.68	11.49	101.7	$8.55	$12.96
1¼ by 3/16	73.9	6.54	9.18	87.2	7.41	10.77	100.5	8.28	12.36	113.7	9.18	13.65	127.0	10.05	15.51
1¼ by ¼	98.6	7.41	11.58	116.3	8.55	13.50	134.0	9.69	15.51	151.7	10.86	17.55	169.4	12.00	19.59

STIRRUPS—SINGLE



A.	B.	C.	2 by ⅜ in.		2 by ½ in.		2½ by ½ in.		3 by ½ in.	
			Lb.	Cost	Lb.	Cost	Lb.	Cost	Lb.	Cost
3	7	3	5.53	$0.72	7.37	$1.16				
3	8	3	5.95	0.75	7.93	1.20				
3	9	3	6.38	0.81	8.50	1.30				
3	10	3	6.80	0.85	9.07	1.36				
3	12	3	7.65	0.94	10.20	1.50				
4	8	4	6.59	0.82	8.78	1.31				
4	9	4	7.01	0.86	9.35	1.38	11.69	$1.73		
4	10	4	7.44	0.92	9.92	1.48	12.40	1.85		
4	12	4	8.29	1.01	11.05	1.62	13.81	2.03		
6	7	3	6.81	0.85	9.07	1.36				
6	8	3	7.22	0.89	9.63	1.35				
6	9	3	7.65	0.95	10.20	1.52	12.75	1.89		
6	10	3	8.08	0.99	10.77	1.58	13.46	1.98		
6	12	3	8.93	1.88	11.90	1.74	14.88	2.18	17.85	$3.26
6	8	4	7.44	0.92	9.92	1.48				
6	10	4	8.29	1.01	11.05	1.62				
6	6	6	7.01	0.87	9.35	1.39				
6	7	6	7.44	0.92	9.92	1.48				
6	8	6	7.86	0.96	10.48	1.54	13.10	1.92		
6	9	6	8.29	1.01	11.05	1.62	13.81	2.03		
6	10	6	8.71	1.07	11.62	1.71	14.52	2.14		
6	12	6	9.56	1.16	12.75	1.85	15.94	2.31	19.13	3.47
6	14	6	10.41	1.26	13.88	2.01	17.35	2.51	20.82	3.77
8	12	4	9.99	1.24	13.32	1.98	16.65	2.48	19.98	3.71
8	8	8	9.14	1.12	12.18	1.79	12.23	2.23		
8	12	8	10.84	1.63	14.45	2.60	18.06	3.24	21.68	4.86

Double stirrups are not carried in stock. Prices are from 66 to 100 per cent greater than for the single.



Hook Anchors

Section, inches	16		20		24		29		32		36	
	Lb.	Cost	Lb.	Cost	Lb.	Cost	Lb.	Cost	Lb.	Cost	Lb.	Cost
1¼ by ¼	2.35	$0.30	2.74	$0.34	3.06	$0.41						
1½ by ¼	2.69	0.38	3.11	0.42	3.54	0.46	4.07	$0.49				
1½ by ⅜	3.69	0.42	1.33	0.50	4.97	0.57	5.76	0.62	6.24	$0.66	6.88	$0.73

Side Anchors

Section, inches	12 in.		16 in.		18 in.		20 in.	
	Lb.	Cost	Lb.	Cost	Lb.	Cost	Lb.	Cost
1 by ¼	1.66	$0.23						
1¼ by ¼	1.91	0.25	2.26	$0.29				
1½ by ¼	2.16	0.30	2.58	0.34	2.80	$0.36		
1½ by ⅜	2.90	0.35	3.54	0.42	3.85	0.44	4.17	$0.47

Wedges—Each

Section, inches	4		6		8		10		12		14		16		18		20		24		28		30	
	Lb.	$	Lb.	$	Lb.	$	Lb.	$	Lb.	$	Lb.	$	Lb.	$	Lb.	$	Lb.	$	Lb.	$	Lb.	$	Lb.	$
2 by ¼	.28	.10	.43	.11	.57	.14	.71	.16	.85	.17	.98	.19	1.13	.24	1.28	.32	1.42	.34	1.7	.51	1.98	.62	2.13	.80
2 by ⅜	.43	.13	.64	.14	.85	.16	1.07	.18	1.28	.19	1.49	.21	1.71	.24	1.92	.32	2.13	.34	2.56	.51	2.98	.62	3.20	.80
2 by ½	.57	.14	.85	.16	1.13	.18	1.42	.19	1.70	.19	1.98	.22	2.27	.24	2.55	.32	2.83	.34	3.40	.51	3.97	.62	4.25	.80
2 by ¾	.77	.19	1.28	.21	1.70	.24	2.12	.29	2.55	.29	2.97	.32	3.40	.34	3.83	.40	4.25	.54	5.10	.67	5.95	.78	6.28	.96
2 by 1	1.13	.23	1.70	.26	2.27	.32	2.83	.38	3.40	.45	3.97	.51	4.53	.56	5.10	.61	5.67	.66	6.80	.78	7.93	.90	8.50	1.07
2 by 1½	1.70	.34	2.55	.42	3.40	.50	4.25	.58	5.10	.64	5.95	.72	6.80	.78	7.65	.85	8.50	.99	10.20	1.12	11.90	1.23	12.75	1.41
2½ by ⅜	.53	.13	.80	.13	1.06	.18	1.33	.18	1.59	.19	1.86	.22	2.13	.24	2.39	.32	2.66	.38	3.19	.51	3.72	.62	3.99	.80
2½ by ½	.71	.14	1.06	.17	1.42	.24	1.77	.27	2.30	.27	2.48	.29	2.83	.29	3.19	.34	3.54	.46	4.25	.66	4.96	.77	5.31	.94
2½ by ¾	1.06	.21	1.60	.22	2.13	.27	2.66	.32	3.19	.34	3.72	.45	4.25	.46	4.79	.56	5.32	.64	6.38	.78	7.44	.90	7.98	1.07
2½ by 1	1.42	.27	2.13	.30	2.83	.35	3.54	.42	4.25	.48	4.96	.54	5.67	.59	6.38	.64	7.08	.70	8.50	.82	9.92	.93	10.63	1.10
2½ by 1½	2.13	.38	3.19	.46	4.26	.54	5.32	.62	6.38	.69	7.44	.77	8.50	.82	9.57	.90	10.64	1.04	12.76	1.17	14.89	1.28	15.95	1.46
3 by ½	.85	.30	1.28	.32	1.70	.34	2.13	.37	2.55	.40	2.98	.43	3.20	.45	3.83	.53	4.25	.61	5.10	.69	5.95	.85	6.38	.93
3 by ¾	....	...	1.92	.32	2.55	.37	3.19	.42	3.83	.43	4.47	.53	5.11	.56	5.75	.67	6.38	.75	7.66	.85	8.94	.90	9.58	.94
3 by 1	....	...	2.55	.40	3.40	.43	4.25	.48	5.10	.53	5.95	.59	6.80	.61	7.65	.74	8.50	.85	10.20	.90	11.90	.94		

Coping Anchors—Per 100

Section, inches	6 in.			8 in.			10 in.		
	Lb.	Cost		Lb.	Cost		Lb.	Cost	
		Plain	Galv.		Plain	Galv.		Plain	Galv.
1 by 3/16	43	$ 6.12	$ 7.68	53	$ 7.44	$ 9.30	64	$ 8.76	$10.92
1¼ by 3/16	53	7.68	9.60	66	9.06	11.70	80	11.04	13.80
1¼ by ¼	71	10.20	12.72	89	12.35	15.42	106	14.49	18.12
1½ by ⅜	127	18.00	22.80	159	22.08	27.60	191	25.92	32.40
1½ by ½	170	24.00	30.00	213	29.04	36.30	255	34.08	42.60
¾ dia.	100	14.40	18.00	125	17.40	21.75	150	20.40	25.50
½ dia.	45	6.39	8.04	56	7.76	9.69	67	9.08	11.34

Form Hangers—Each

Section, inches	24 in.		30 in.		34 in.		36 in.	
	Lb.	Cost	Lb.	Cost	Lb.	Cost	Lb.	Cost
¾-in. dia.	5.25	$1.20	6.00	$1.26	6.50	$1.32	6.75	$1.35
⅞-in. dia.	9.70	1.49	10.70	1.56	11.40	1.62	11.75	1.65
1-in. dia.	11.37	2.25	12.75	2.37	13.60	2.43	14.10	2.46

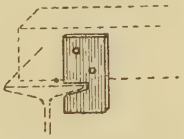
Government Anchors

Section, inches	12 in.		15 in.		18 in.	
	Lb.	Cost	Lb.	Cost	Lb.	Cost
⅝-in. dia.	1.04	$0.120	1.30	$0.135	1.56	$0.159
¾-in. dia.	1.50	0.159	1.88	0.198	2.35	0.231

Strap Anchors

Section, inches	12 in.		14 in.		16 in.		18 in.	
	Lb.	Cost	Lb.	Cost	Lb.	Cost	Lb.	Cost
1¼ by 3/16	0.80	$0.132	0.93	$0.144	1.06	.....	1.20	
1½ by ¼	1.28	0.156	1.49	0.18	1.70	$0.204	1.91	
1½ by ⅜	1.91	0.204	2.23	0.24	2.55	0.276	2.87	$0.30

Sleeper Clips—Per 100

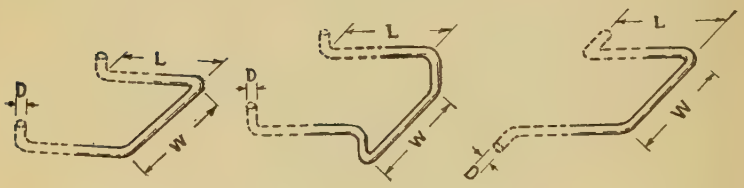


Size	Weight	Cost	Size	Weight	Cost	Size	Weight	Cost	Size	Weight	Cost
2½	708	$ 9.09	5	1,417	$17.13	7½	2,125	$32.22	10	2,833	$46.29
3	850	10.05	5½	1,558	21.51	8	2,267	35.27	10½	2,975	46.47
3½	992	11.52	6	1,700	25.95	8½	2,408	38.25	11	3,117	58.77
4	1,133	13.23	6½	1,842	27.57	9	2,550	39.18	11½	3,258	64.89
4½	1,275	14.97	7	1,983	29.16	9½	2,692	40.08	12	3,400	71.25

Pipe Hangers

Pipe	¾ in.	1 in.	1¼ in.	1½ in.	2 in.	2½ in.	3 in.	3½ in.	4 in.	4½ in.	5 in.	6 in.
Section												
1¼ by ¼	0.45	0.48	0.48	0.54								
1½ by ¼	....	....	....	....	0.57	0.69						
1½ by ⅜	....	....	....	....	....	....	1.02	1.08	1.14	1.20	1.29	1.44

Sewer Steps



L.	W.	D.	No. 1				No. 3			Lb.	No. 4		
			Lb.	Plain, cost	Ptd., cost	Galv., cost	Plain, cost	Ptd., cost	Galv., cost		Plain, cost	Ptd., cost	Galv., cost
6	8	½	1.34	$0.135	$0.195	$0.195	$0.173	$0.225	$0.225	1.56	$0.195	$0.248	$0.248
6	8	⅝	2.09	0.195	0.248	0.285	0.225	0.285	0.315	2.43	0.248	0.308	0.338
8	8	¾	3.51	0.308	0.360	0.465	0.353	0.405	0 510	4.01	0.375	0 428	0.533
10	8	⅝	2.78	0.248	0.338	0.375	0.285	0.375	0.405	3.13	0.308	0.398	0.428
10	8	¾	4.01	0.353	0 450	0.533	0.383	0.486	0.563	4.51	0.398	0.495	0.578
12	12	¾	4 88	0 420	0.533	0.645	0 450	0.563	0.675	5.51	0.473	0 585	0.698
12	12	1	8.68	0.713	0 825	1.103	0.720	0.855	1.118	9.79	0.758	0.878	1.148

Washers

Wrought iron

U. S. standard sizes—in effect January 20, 1910

Diameter, inches	Size of hole, inches	Thickness, Bir. wire gage number	Size of bolt, inches	Number in 100 lb.
9/16	1/4	18	3/16	39,400
3/4	5/16	16	1/4	15,600
7/8	3/8	16	5/16	11,250
1	7/16	14	3/8	6,800
1 1/4	1/2	14	7/16	4,300
1 3/8	9/16	12	1/2	2,600
1 1/2	5/8	12	9/16	2,250
1 3/4	1 1/16	10	5/8	1,300
2	1 3/16	9	3/4	900
2 1/4	1 5/16	8	7/8	782
2 1/2	1 1/16	8	1	568
2 3/4	1 1/4	8	1 1/8	473
3	1 3/8	8	1 1/4	364
3 1/4	1 1/2	7	1 3/8	275
3 1/2	1 5/8	7	1 1/2	256
3 3/4	1 3/4	7	1 5/8	220
4	1 7/8	7	1 3/4	197
4 1/4	2	7	1 7/8	174
4 1/2	2 1/8	7	2	160
4 3/4	2 3/8	5	2 1/4	122
5	2 5/8	4	2 1/2	106

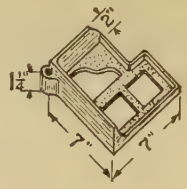
Average price about 8 cts. per pound.

Cast iron

Diameter, inches	Size of hole, inches	Thickness, inches	Size of bolt, inches	Weight, pounds
2 1/2	5/8	1 1/16	1/2	1/2
2 3/4	3/4	3/4	5/8	5/8
3	7/8	1 3/16	3/4	3/4
3 1/2	1	7/8	7/8	1 1/4
4	1 1/8	1 5/16	1	1 5/8
4 1/2	1 1/4	1	1 1/8	2 1/4
5	1 3/8	1 1/8	1 1/4	3
6	1 3/4	1 1/4	1 1/2	5

Average price about 5 cts. per pound.

CAST-IRON SHUTTER EYES—$0.60 per pair



ASH PIT DOORS OR TRAPS

6½ by 8½—$1.50 each 4½ by 7¼—$1.30 each

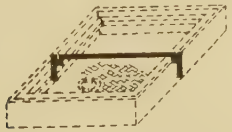
CLEAN-OUT DOORS

Size, inches	Each	Size, inches	Each	Size, inches	Each
8 by 8	$2.75	12½ by 18½	$11.20	18½ by 20½	$13.20
8 by 12	3.30	14½ by 14½	10.40	20 by 16	8.75
10 by 10	3.40	16 by 16	6.00	21 by 32	18.75
10 by 12	3.70	16 by 20	7.00	24 by 24	16.00
12 by 12	4.20	16 by 28	15.25	24½ by 30½	29.50
12 by 16	6.00	18½ by 17½	12.80	30½ by 36½	46.00

Cast-iron Coal Hole Covers and Frames

Diameter		Deep frame for concrete	Shallow frame for stone
Cover, inches	Frame, inches		
17	22	$15.00	$11.25
19	24	18.00	13.50
21	26	20.25	15.00

Cast-iron Manhole Cover and Frame



Cover, inches	Frame, inches	Price
12 by 12	12¾ by 12¾ by 3	$ 7.50
12 by 18	12¾ by 18¾ by 3	10.50
24 by 24	25 by 25 by 3	18.00

CAST-IRON SUMP PIT COVER AND FRAME

Cover, inches	Frame, inches	Price
20 by 20	25 by 25	$18.00
24 by 24	29 by 29	28.00
36 by 36	41 by 41	40.50

PLATE ANCHORS—PRICE EACH

Section, inches	20 in.	24 in.	28 in.	36 in.
½ dia.	$0.30			
⅝ dia.	0.348	$0.384	$0.42	
¾ dia.	0.492	0.534	0.576	$0.666

Columns

Steel shell—concrete filled, including cap and base
Safe load in tons—safety factor of 4

Length, feet	3 in.		3½ in.		4 in.		4½ in.		5 in.		6 in.	
	Tons		Tons		Tons		Tons		Tons		Tons	
6	6	$3.00	9	$3.60	13	$4.00	14	$12.60	20	$15.90	28	$20.10
7	5	3.00	8	3.60	12	4.00	13	12.60	19	15.90	27	20.10
8	4	3.30	7	4.20	11	4.50	12	14.10	18	18.00	26	22.50
9	..	....	7	5.60	11	5.80	12	15.90	18	19.95	26	25.05
10	..	....	6	6.50	10	6.75	11	17.50	17	20.05	25	27.60
11	..	....	..	....	9	7.65	10	19.00	16	24.00	24	30.00
12	..	....	..	....	8	8.60	9	20.60	15	26.10	23	32.55
13	..	....	..	....	7	9.00	8	22.20	15	27.90	23	35.10
14	..	....	..	....	..	....	8	23.85	14	30.00	22	37.50
15	..	....	..	....	..	....	..	.....	14	32.10	22	42.00
16	..	....	..	....	..	....	..	.....	13	34.05	21	42.60
17	..	....	..	....	..	....	..	....	12	36.00	21	45.00
18	..	....	..	....	..	....	..	.....	..	.....	20	47.55

SAFETY TREADS

Composition safety treads composed of carborundum or similar abrasive in a base of lead, cast iron, cement, bronze, etc. are manufactured in various patterns. The principal manufacturers are: The American Abrasive Metals Company, of New York, The American Mason Safety Tread Company, of Lowell, Mass., The Universal Safety Tread Company, of Boston, Mass., and the Norton Company, of Worcester, Mass. These companies have agencies in most of the big cities.

Safety treads are usually built in with the stairs or other new work. On old work or repair jobs, the labor required to install is so variable that it is impossible to give any definite figures. The following prices are given through the courtesy of The American Abrasive Metals Company, and are the average prices to the contractor f.o.b. New York City for their Feralum treads.

Treads are usually made 4, 4½, 5 and 6 in. wide and not over 72 in. long in one piece. Large areas are made in sections. Style *A* is most commonly used, costs $1.50 per square foot, and is $\frac{5}{16}$ in. thick.

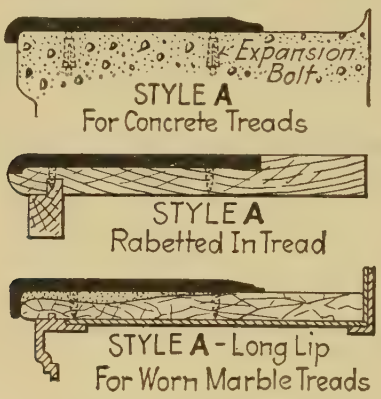


FIG. 1.—Safety treads.

Cast-iron anti-slip treads for stairs that do not require a subtread are made in various types, costing from $1.85 to $2.20 per square foot.

Door saddles ½ in. thick cost $2.15 per square foot.

Elevator door saddles with or without grooves cost $2.40 per square foot.

Trench covers and floor plates ½ in. thick cost $1.95 per square foot.

Safety coal and manhole covers and frames 20 by 20 in. cost $23 each, and 24 by 24 in. $27 each.

Ornamental Iron

C.I. Leader shoe

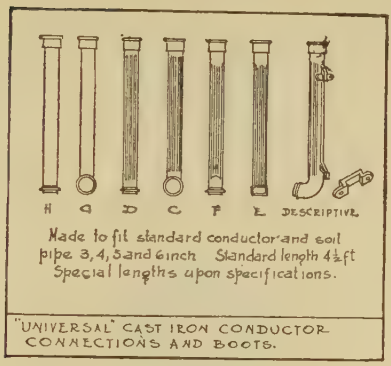


Fig. 2.

	H. & G. Each	D. & C. Each	F. & E. Each
3 in	$5.18	$5.32	$ 5.94
4 in	6.13	6.65	7.13
5 in	7.41	7.70	9.02
6 in	8.36	9.02	10.02

Sidewalk Doors

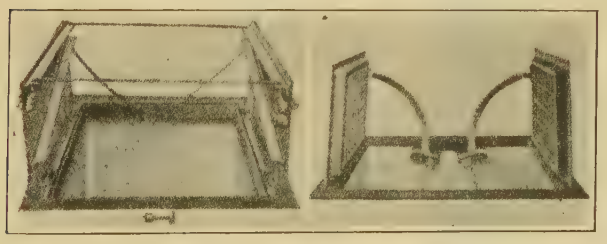


Fig. 3.—Sidewalk doors, showing stay rods and ratchet.

30 by 42	$65.60	36 by 60	$ 80.00
30 by 54	70.40	36 by 72	84.80
36 by 36	65.60	48 by 72	99.20
36 by 48	73.60	72 by 60	105.60

SIDEWALK DOORS—ILLUMINATED

Glass 16 cts. each extra. Concrete not included

	Lights			Lights	
30 by 42	36	$80.00	36 by 60	96	$96.00
30 by 54	54	84.00	36 by 72	98	102.40
36 by 36	48	80.00	48 by 72	140	120.00
36 by 48	64	88.00	72 by 60	192	128.00

ILLUMINATED RINGS AND COVERS

14 in. dia	$ 9.60	24 in. dia	$20.00
18 in. dia	12.80	36 in. dia	40.00

Area gratings, wrought iron, $1.60 per square foot.
Sidewalk or vault lights, in units 24 by 48 in. cost $4.50 per square foot.

MAIL CHUTES

Mail chutes are installed in office buildings, hotels, apartment houses, etc. in connection with the Government Collection Service. They are installed on a contract form required by the Post Office Department subject to the approval of the local postmaster. The mail box is always included as a part of the installation which is furnished and installed complete by the makers. The rough floor openings are provided by the general contractor.

FIG. 4.—U. S. mail box in bronze, electro-bronze or dead black size over all, 36 in. by 21½ in. by 11¼ in.

Cost of Mail Chutes.—The cost varies with the conditions, story heights, etc., but may be approximately estimated at $150 per story for the standard equipment including a box such as illustrated in the accompanying cut, which is a Cutler Stock Design No. 1165. Bronze finish in the first story will add $75 to the cost. A mail box of more elaborate design can be furnished and will cost from $100 up according to the amount of elaboration and character of design. The makers offer a variety of spe-

cial designs in different architectural styles which can be furnished much cheaper than designs requiring special modeling and pattern making.

There are two companies which manufacture mail chutes, the Cutler Mail Chute Company, of Rochester, N. Y. and the American Mailing Device Corporation, of New York City.

WALL SAFES

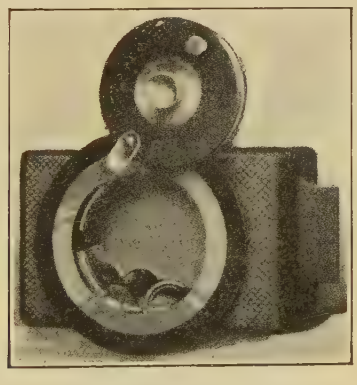


FIG. 5.—Round door wall safe.

Outside measurements				Inside measurements					
No.	Height, in.	Width, in.	Depth, in.	Height, in.	Width, in.	Depth, in.	Door opening, in.	Weight, lb.	Price
1	7½	11½	8	6¾	10¾	7⅛	5½	70	$42.00
2	10½	15	8	9¾	14¼	7⅛	5½	100	45.00

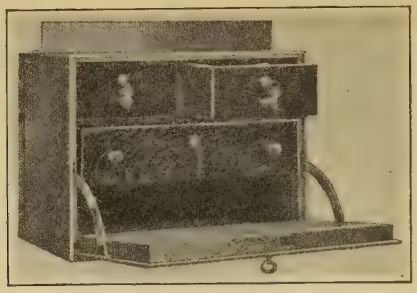


FIG. 6.—Square door wall safe.

Outside				Inside				
No.	Height, in.	Width, in.	Depth, in.	Height, in.	Width, in.	Depth, in.	Weight, lb.	Price
15	15	23	9¾	14¼	21⅝	8⅝	60	$50.00
25	12	15¾	9¾	11¼	14⅝	8⅝	45	45.00
30	12	12	9¾	11⅛	11⅛	9⅛	30	20.00

No. 30 has no filling in door. Door is sheet steel and opens to right like a cash box.

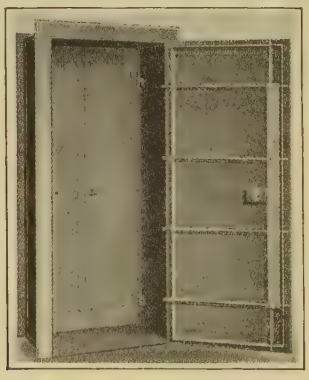


FIG. 7.—Fireproof vault front.

Dimensions.—Outside, 80½ in. high, 33½ in. wide, 20 in. deep. Wall opening required, 81½ in. high, 34½ in. wide. Clear opening through vestibule, 77¾ in. high, 29 in. wide. The inside doors will pocket in a vestibule 17¾ in. or more deep.

Bolt Work.—The outer door is locked with six 1 in. round locking bolts, four cross, one up and one down, operating through an angle bolt frame. When the door is closed, the horizontal bolts project behind the door frame at rear of door, thereby forming ten locking points. Bolts checked by Herring-Hall-Marvin Safe Co., four tumbler combination lock, having black dial with white numerals. Bolt work thrown by nickel-plated drop lever handle with hard rubber grip.

Inside Doors.—The inside doors of ¾ in. open-hearth steel fold back into the vestibule. They are hung on steel pin hinges. The inside doors are locked by up and down flat bolt work on the right-hand door checked by key lock.

Weight.—(Approx.) 670 lb.

Price.—$140.00. Freight allowed to destination.

CHAPTER XXI

FINISHED HARDWARE

There is such a vast variety of hardware both as to quality and finish that it is almost impossible to give reliable data regarding unit prices. The prices of hardware that are right today are not necessarily so a year from now. The following prices will, however, give some idea of the present market for standard varieties of the more common kinds:

HARDWARE FOR OFFICE BUILDINGS

Single door, corridor to offices (not including transom)
Three butts, ball-bearing, wrought-steel, bronze-plated.
Cylinder master-keyed office entrance door lock, cast-bronze knobs and roses.
Liquid door check and spring.
Cast-bronze letter box plate and inside hood.
$24.00

Transoms over doors (pivoted)
Cast-iron friction sash centers, bronze-plated.
Cast-bronze transom catch.
3.50

Transoms over doors (hinged bottom)
Wrought-steel butts, bronze-plated.
Cast-bronze transom catch.
Wrought-bronze transom chain.
3.50

Doors, corridor from janitor's closets, etc.
Three butts, ball-bearing, wrought-steel, bronze-plated.
Cylinder master-keyed lock with locking device to prevent latch being retracted except by key for doors opening out, cast-bronze knobs and roses.
15.50

Stair doors (latch type)
Three butts, ball-bearing, wrought-steel, bronze-plated.
Knob latch meeting requirements of Board of Underwriters with cast-bronze knobs and escutcheons.
Liquid door check and spring.
18.50

Stair doors (lock type)

Three butts ball-bearing, wrought-steel, bronze-plated.
Cylinder master-keyed lock operated by knob at all times from corridor side, and by key from stair side, cast-bronze knobs and escutcheons, meeting requirements of Board of Underwriters.
Liquid door check and spring.

$29.00

Doors between offices (communicating)

Three butts ball-bearing, wrought-steel, bronze-plated.
Communicating door lock, latch bolt by knob from either side, dead bolts by small thumb knob from both sides, each locking against the opposite side, cast-bronze knobs and roses.

10.00

Fire tower street exit

Three cast-bronze butts with interlocking pin.
Cylinder master-keyed lock operated by cast-bronze exit fixture from inside and by key from outside.
Liquid door check and spring secured on inside by bracket.

49.50

Pipe and electric chase door

Two wrought-steel butts, bronze-plated.
Cylinder dead lock, master-keyed, operated by key from outside and by safety thumb knob from inside.

8.50

Double hung sash

One cast-bronze sash fast of large size.
Two cast-bronze bar type lifts.
One cast-bronze pole socket for upper sash.
And wrought-bronze screws and washers for stop beads.

1.50

Entrance door, corridor to toilets

Three butts, ball-bearing, wrought-steel, bronze-plated.
Cylinder master-keyed lock by key from corridor side, and by knob at all times from room side, knob on corridor side can be made operative by master key on inside cylinder, cast-bronze knobs and roses.
Liquid door check and spring.

23.50

W. C. stalls

Two box flange spring hinges.
One surface slide bolt with box flange strike and stop for marble.
One hat and coat hook with rubber bumper.

$10.25

HARDWARE FOR RESIDENCES

Front door (single)

Three cast-brass or bronze butts.
One set "sectional" thumb latch handles with cylinder front door lock, all of cast brass or bronze.

18.00

Front door (Dutch)

Four cast-brass or bronze butts.
One-cylinder front door lock with cast-brass or bronze knobs and roses for lower half.
One-cylinder dead lock by key from outside and small thumb knob inside for upper half.
One surface Dutch door quadrant of cast brass or bronze to secure both leaves together.

34.50

Interior doors (master's part)

Two cast-iron butts, brass- or bronze-plated.
Mortise locks (1 tumbler) with pressed-glass knobs and Colonial key plate escutcheons of cast brass or bronze.

5.50

Doors, service quarters,

Two cast-iron butts, brass- or bronze-plated.
Mortise lock (1 tumbler) with porcelain knob with wrought-brass or bronze shank and roses and key plate escutcheons of wrought brass or bronze.

3.00

Double hung sash

One cast-brass or bronze sash fast of medium size.
Two wrought-brass or bronze sash lifts of flush type.
Wrought-brass or bronze washers and screws for stop bead.

0.90

Pair French sash doors

Three cast-iron butts (for each leaf) brass or bronze plated.
Two cast-brass or bronze top and bottom flush bolts.
One mortise French window lock (3 tumbler) with lever handles and knobs and Colonial key plate escutcheons, all of cast brass or bronze.

$24.00

In ordering door hardware it is always necessary to tell whether the door is right or left hand. Many estimators are confused in deciding for any given case just which is required. The following cut will answer this question.

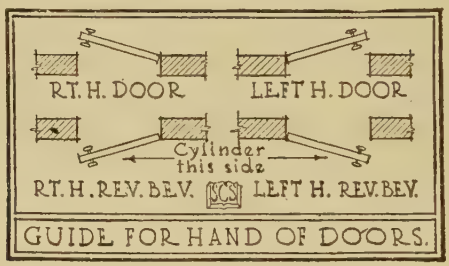


FIG. 1.

HARDWARE FOR SLIDING DOORS

There are several manufacturers of this class of hardware, but perhaps one of the oldest and best known is the Coburn Trolley Track Manufacturing Company, which has furnished the following data. (See also Fire Doors, p. 401.)

Coburn House, Barn and Garage Door Hangers.—These hangers are made to suit various requirements. In specifying track, hangers and brackets, it is always essential to give the thickness of doors.

Track: for doors of 300 lb. or less No. 1 track is used; 500 lb. or less No. 2½ track; 1,200 lb. or less, No. 4 track; doors exceeding 1,200 lb. require special track. Tracks Nos. 1 and 2½ are No. 16-gage steel; No. 4 is No. 13-gage steel.

Curved tracks are furnished on correct radius for clearance of corner doors of different width.

There are many varieties of tacks and hangers but those illustrated in the cuts shown above are the ones that have the largest sale and the prices for them are as follows:

Hangers No. 137-*A-B-C* cost $3, $4 and $6 respectively per door.

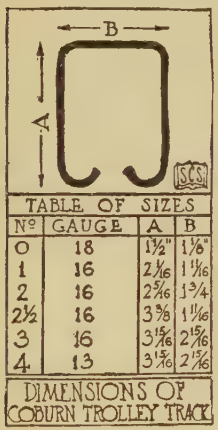


Fig. 2.

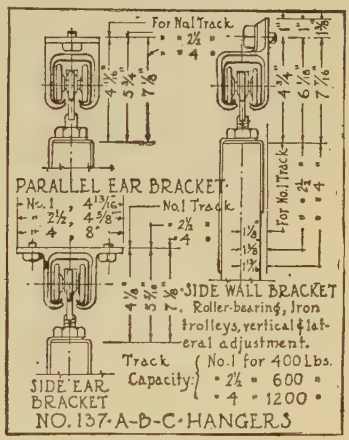


Fig. 3.

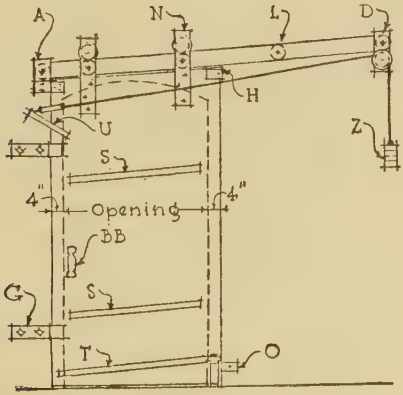


Fig. 4.—Incline sliding door.

The track as shown in Fig. 3 costs 20, 30 and 50 cts. per lineal foot.

The brackets for the three sizes above cost 20, 35 and 80 cts. each respectively.

All of these prices are f.o.b. Holyoke, Mass.

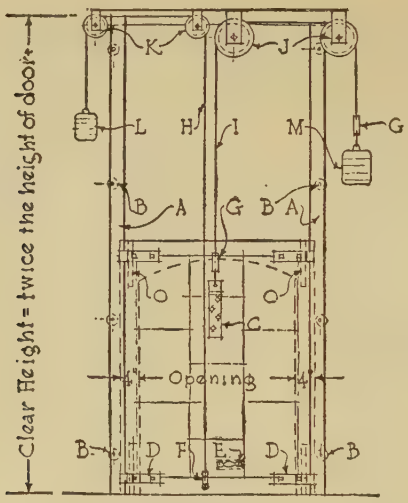


FIG. 5.—Vertical sliding door.

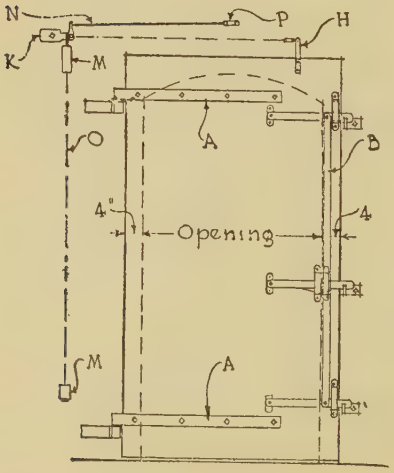


FIG. 6.—Swing door.

Hardware for Fire Doors.—There are three general types of fire doors; the incline slide (see Fig. 4), the vertical slide (see Fig. 5), and the swing door (see Fig. 6), each of which is approved under certain conditions by the National Board of Underwriters. In the case of the inclined slide door the local Boards of the Fire Underwriters have provided somewhat different arrangements for various parts of the country. For instance, there is a New York type, a Philadelphia type and a Cincinnati type. The prices vary slightly due to the amount of material required. In the case of the swing door and the vertical slide, the types are standard throughout the United States. There are several makes of this kind of hardware, but the price does not vary to a great extent.

The following table gives the average prices for such hardware.

INCLINE SLIDE DOOR

Style	Width of door	
	3 ft.	10 ft.
New York	$19.50	$26.50
Philadelphia	19.50	31.30
Cincinnati	.....	29.90

Intermediate widths in proportion.
Swing door—3 by 7 in. opening—$16 f.o.b. Holyoke, Mass.
Vertical door—3 by 7 in. opening —$36 f.o.b. Holyoke, Mass.

CHAPTER XXII

ELEVATORS AND DUMBWAITERS

ELEVATORS

Cost of Elevators.—The following information will give a very good idea of the cost of various elevator installations. The prices given do not include preparatory work, such as the building of the shaft, elevator doors, enclosures, pent houses, pits, machine rooms, machinery supports, position indicators, pneumatic door devices, interlocks, etc. These prices are for electrically operated installations:

Typical 6-story apartment house elevator..... $ 5,000
2,500 lb. at 150 ft. per minute or
2,000 lb. at 200 ft. per minute
Machine below
Car value $500

Typical 14-story apartment house elevator..... $ 7,000
2,500 lb. at 250 ft. per minute or
2,000 lb. at 300 ft. per minute
Machine below
Car value $500

Typical 10–12 story loft building elevator..... $ 7,000
4,000 lb. at 200 ft. per minute or
2,500 lb. at 300 ft. per minute
Machine overhead
Car value $500

Typical 14-story combination office and loft building elevator.. $ 8,800
2,500 lb. at 400 ft. per minute or
3,000 lb. at 350 ft. per minute
Machine overhead
Car value $600

Typical 16-story office building gearless elevator..... $16,000
2,500 lb. at 600 ft. per minute
Machine overhead
Car value $1,000

In the case of the combination loft and office building, and of the office building, from $2,000 to $2,500 must be added per elevator for a flashlight signal system.

Hand-power Elevators.—There is not a very great demand for hand-power elevators, but they are occasionally required. The approximate cost of a hand-power elevator, 2,000 lb. capacity, for a three story building is $1,000, and $75 for each additional story.

DUMBWAITERS

Cost of Dumbwaiters.—Dumbwaiters are operated either by hand power or by electricity. In the case of electric dumbwaiters, they

FIG. 1.—Hand power dumbwaiter.

are usually run on steel supports, and are of a much better grade in every way. The hand-power dumbwaiters are used in restaurants, medium-sized apartment buildings and to a small extent in private houses. The cost of an ordinary hand-power dumbwaiter for a five-story apartment house installed complete is about $150, and about $15 extra for each additional story. The cost of an electric dumbwaiter for a five-story apartment house in approximately $2,500, and $100 for each additional story.

CHAPTER XXIII

PLUMBING

In estimating plumbing no attempt should be made to estimate roughing in, gas piping, fixtures, etc. together, but all items of each class should be taken separately as by this method there is less chance of overlooking something. The specifications and the general conditions should be studied including the parts applying to other trades. One must ascertain who is to do the cutting and patching. Sometimes the mason is required to dig the trenches, and occasionally there is a duplication of work specified, in that both the mason and the plumber are required to dig the trenches. If so, a statement should be obtained in writing from the architect if the mason is to do this work, or such statement should be included in the bid.

An item in the plumber's estimate which must not be omitted is the charge for opening a street, tapping the water main, making sewer connections, etc. If the specifications call for a connection other than standard its cost must be obtained from the water company. The cost of opening the street will depend on whether or not the street is paved and the kind of paving. For data on the cost of excavating trenches see "Excavation." It is reasonable and advisable to hold the one who makes the opening in the street responsible for its backfilling in such a manner as to avoid settlement. The following procedure has been the custom in New York City for the past eight years: The contractor, plumber or corporation that makes an opening is required to guarantee that no settlement shall occur in the refilled trench for six months after backfilling. In contracts with New York City, sufficient money is held back for six months to cover the cost of repaving if it should become necessary. Corporations must furnish bonds and plumbers are required to deposit a sum equal to twice the estimated cost of repaving. This money is held for six months, and if the filled area has to be repaved a second time, the work is done by the city and charged to the plumber.

The following is the estimated cost for paving street openings in New York City:

Cost of Making Openings in Streets

Opening for water in sheet asphalts	16 sq. yd. @	$5	$1 for permit	$ 81
Opening for sewer in sheet asphalts	24 sq. yd. @	5	1 for permit	121
Opening for water in wood block	16 sq. yd. @	6	1 for permit	97
Opening for sewer in wood block	24 sq. yd. @	6	1 for permit	145
Opening for water in granite on concrete	16 sq. yd. @	3	1 for permit	58
Opening for sewer in granite on concrete	24 sq. yd. @	3	1 for permit	87
Opening for water in granite on sand	16 sq. yd. @	1	1 for permit	17
Opening for sewer in granite on sand	24 sq. yd. @	1	1 for permit	25
Opening for water in macadam	16 sq. yd. @	2	1 for permit	33
Opening for sewer in macadam	24 sq. yd. @	2	1 for permit	49

Usually only the size and the material of the pipe are indicated on the plans. For other details such as the finish of the pipe (plain or galvanized), the kind of fittings, etc., the specifications must be consulted. No deductions should be made for fittings, when taking off lengths of cast-iron soil and drain pipe, unless the fittings are bunched so that no pipe is required. The gross length is taken to compensate for the waste in cutting lengths at the fittings.

Cost of Laying Cast-iron Water Pipe.—The accompanying diagram giving the cost of labor for laying cast iron water pipe was prepared by Dabney H. Murray, Consulting Engineer of Chicago, and was published in the *Engineering News Record* of May 11, 1922. It was compiled from actual costs of laying cast-iron pipe in ten water work plants. The figures shown in the diagram have been compared with costs in a number of other cities and found on the average to check closely.

To use the diagram, follow the direction arrows from trench depths to the size of pipe, then to common labor cost and cost per foot. To this labor cost must be added the cost of lead and jute. For example, to find the cost of laying an 8-in. pipe in a trench 4 ft. deep, with lead at 6 cts. a pound, jute at 8 cts. a pound and common labor at 20 cts. per hour, the dotted line should be followed and the cost found for excavating, laying and backfilling at 22 cts. per foot. To this cost is added 6.6 cts. for lead and 0.8 cts. for jute, making a total of 28.9 cts. per lineal foot. The diagram applies to work in ordinary soils not requiring sheet piling, pumping or presenting other unusual difficulties. The costs shown, however, include the foreman's wages and ordinary contingencies, but no allowance is made for interest during construction, for the contractor's profit or for engineering.

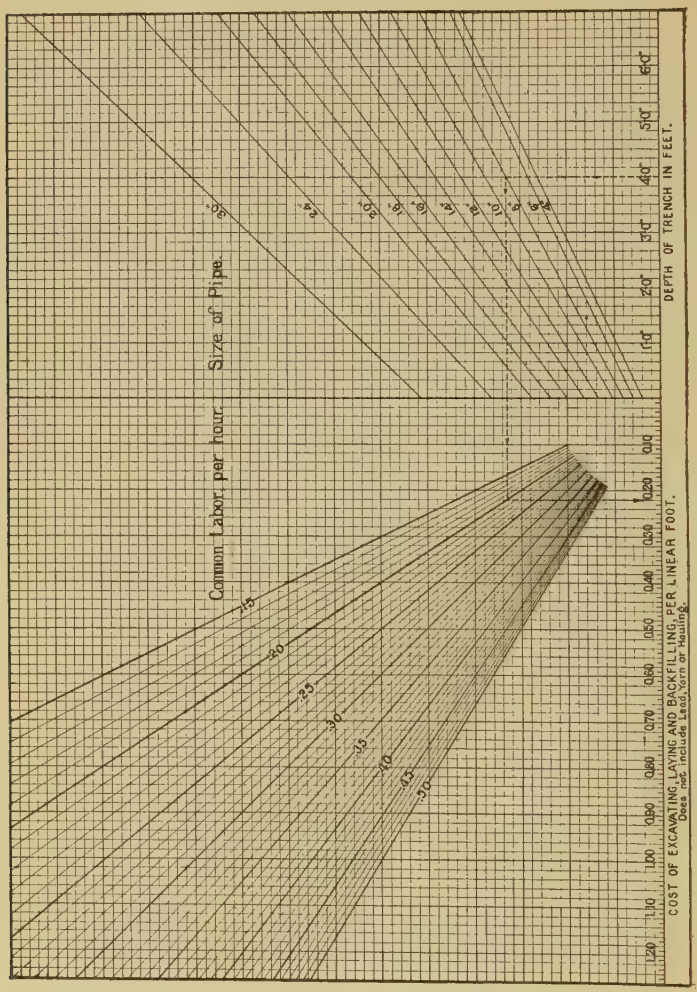

COST OF EXCAVATING, LAYING AND BACKFILLING, PER LINEAR FOOT.
Does not include Lead, Yarn or Hauling.
DEPTH OF TRENCH IN FEET.
Common Labor per hour.
Size of Pipe.
.15
.20
.25
.30
.35
.40
.45
.50
.55
.60

FIG. 1.

The cost of cast-iron pipe, class *B*, is $72 per ton for 6-in. and over and $77 per ton for 6-in. and under. Other classes cost $5 per ton more than class *B*. Fittings cost 7½ cts. a pound for 6-in. and over and 8 cts. per pound for those under 6-in.

WEIGHT IN POUNDS OF LEAD AND JUTE REQUIRED PER JOINT FOR CAULKING CAST-IRON PIPE

	3	4	6	8	10	12	14	16	18	20	24	30	36
Lead, lb	6.00	7.50	10.25	13.25	16.00	19.00	22.00	30.00	33.80	37.00	44.00	54.25	64.75
Jute, lb	0.18	0.21	0.31	0.44	0.53	0.61	0.81	0.94	1.00	1.25	1.50	2.06	2.00

CAST-IRON PIPE

Bell and spigot cast-iron pipe is usually sold in 12 ft. lengths, and is made in four weights as shown in the accompanying table.

While the above table is made out for 12-ft. lengths of pipe, it is possible to obtain 16-ft. lengths for all but the larger sizes. By using 16-ft. lengths there is a saving of 25 per cent in the number of joints, and also a saving of from 2 to 2½ per cent in the weight of the pipe. The section of the 16-in. pipe is the same in every way as for the 12 in. It also has the same bell and spigot, the only saving being that fewer joints are required for the given length of run.

To determine the right- or left-hand inlet or outlet in bends, branches and offsets, the fittings should be placed with the hub facing towards one and with the spigot lower than the hub. On traps, they should be placed in regular position with the hub end nearest.

Long quarter bends are measured from the inside of the hub nearest the spigot to the end of the spigot. Other bends are measured from the end of the spigot to the nearest point on the inside base of the hub. Long T's, Y's, etc. are measured from the base of the hub on the main to the end of the spigot.

Earthenware Sewer Pipe.—To the quantity required 6 per cent should be added for the defective and broken lengths. The labor to lay tile pipe in a trench on boards is approximately 9 hr. per 100 ft.; if bedded in earth, raking out for hubs, 18 hr. per 100 ft.

Weight and Thickness—Bell and Spigot Cast-iron Pipe

(From American Cast Iron Pipe Company)

Nominal inside diameter, inches	Class *A* 100-ft. head 43-lb. pressure			Class *B* 200-ft. head 86-lb. pressure			Class *C* 300-ft. head 130-lb. pressure			Class *D* 400-ft. head 173-lb. pressure			Approximate pounds per joint	
	Thickness, inches	Weight		Thickness, inches	Weight		Thickness, inches	Weight		Thickness, inches	Weight		Hemp	Lead
		Feet	12-ft. length		Feet	12-ft. length		Feet	12-ft. length		Feet	12-ft. length		
3	0.29	14.5	175	0.42	16.2	194	0.45	17.1	205	0.48	18.0	216	0.18	6.00
4	0.42	20.0	240	0.45	21.7	260	0.48	23.3	280	0.52	25.0	300	0.21	7.50
6	0.44	30.8	370	0.48	33.3	400	0.51	35.8	430	0.55	38.3	460	0.31	10.25
8	0.46	42.9	515	0.51	47.5	570	0.56	52.1	625	0.60	55.8	670	0.44	13.25
10	0.50	57.1	685	0.57	63.8	765	0.62	70.8	850	0.68	76.7	920	0.53	16.00
12	0.54	72.5	870	0.62	82.1	985	0.68	91.7	1,100	0.75	100.0	1,200	0.61	19.00
14	0.57	89.6	1,075	0.66	102.5	1,230	0.74	116.7	1,400	0.82	129.2	1,550	0.81	22.00
16	0.60	108.3	1,300	0.70	125.0	1,500	0.80	143.8	1,725	0.89	158.3	1,900	0.94	30.00
18	0.64	129.2	1,550	0.75	150.0	1,800	0.87	175.0	2,100	0.96	191.7	2,300	1.00	33.75
20	0.67	150.0	1,800	0.80	175.0	2,100	0.92	208.3	2,500	1.03	229.2	2,750	1.25	37.00
24	0.76	204.2	2,450	0.89	233.3	2,800	1.04	279.2	3,350	1.16	306.7	3,680	1.50	44.00
30	0.88	291.7	3,500	1.03	333.3	4,000	1.20	400.0	4,800	1.37	450.0	5,400	2.06	54.25
36	0.89	391.7	4,700	1.15	454.2	5,450	1.36	545.8	6,550	1.58	625.0	7,500	3.00	64.75

Approximate Weights of Soil Pipe and Fittings

Style	Standard								Extra heavy							
Size, inches	2	3	4	5	6	8	10	12	2	3	4	5	6	8	10	12
Pipe, pounds per length	18	26	35	45	55	85	115	165	27½	47½	65	85	100	170	225	270
Quarter bends, pounds each	4½	7	10½	13	16½	33	54	58½	6¾	10½	15	19	23½	52	80	95
Sixth bends, pounds each	4	6½	9	11½	14	30	30	48	6	9	13	16½	20	44	50	90
Eighth bends, pounds each	3½	6	8½	10½	13	24	38	42½	5½	8½	12¼	15¼	18¼	40	56	80
T-branch, pounds each	7	11	14½	18½	23	33	42	102	10¼	15¼	21	26½	32½	60	75	166
Sanitary T-branch, pounds each	7½	12	16	20	24	49	100	.....	11	16	22½	28	34½	80	135	210
Crosses, pounds each	9½	14	19	23½	28½	40	70	100	13¼	19¾	27	33½	40½	92	116	176
Sanitary cross, pounds each	10½	15½	20½	25½	31½	52	.....	.....	14½	22	29½	36½	44½	79	161	
Y-branch, pounds each	7½	12	17	22	28	58	106	158	11	17	24	31½	39½	91	136	218
Half Y-branch, pounds each	7	11	15	19	24	.....	.....	.....	10¼	15½	21½	27½	34	90		
Double Y-branch pounds each	10½	16	22½	30	36½	77	121	.....	14¾	23	32	41½	52	100	153	266
Double hubs, pounds each	4	5¾	7½	9	10½	16	21	35	5¾	8¼	10¾	12¾	14¾	30	35	45
S-traps, pounds each	8½	14	21	28½	37½	94	.....	.....	12	20	30	40½	53½	123		
P-traps, pounds each	7	12	17½	24½	31½	80	.....	.....	10½	17¼	25½	34½	45	100		
Running traps, pounds each	8½	13½	19½	26	34	54	.....	.....	11¾	19	27½	37	48	110		
Reducers, pounds each	....	4½	6	7½	9	8	21½	28	....	6¼	8½	10¾	12¾	15	28½	48

TILE PIPE

Size, inches	Standard			Double strength			Freight rates per hundredweight	
	Thickness, inches	Weight per foot	List price per foot	Thickness, inches	Weight per foot	List price per foot		
							Akron to Chicago, Ill.	$0.24
							Akron to Springfield, Ill.	0.27
3	½	7	$ 0.30				Akron to Fort Wayne, Ind.	0.205
4	½	9	0.30				Akron to Louisville, Ky.	0.265
5	⅝	12	0.45				Akron to Washington, D. C.	0.305
6	⅝	15	0.45				Akron to Detroit, Mich.	0.205
8	¾	23	0.70				Akron to Saginaw, Mich.	0.235
9	13/16	28	1.05				Akron to Richmond, Va.	0.335
10	⅞	35	1.05				Akron to Wheeling, W. Va.	0.165
12	1	45	1.35				Akron to Milwaukee, Wis.	0.27
15	1⅛	60	1.80	1¼	75	$ 1.80	Akron to Baltimore, Md.	0.305
18	1¼	85	2.50	1½	118	2.50	Akron to Atlantic City, N. J.	0.385
20	1⅜	100	3.00	1⅝	138	3.00	Akron to Boston, Mass.	0.355
22	1⅝	130	4.00	1⅝	157	4.00	Akron to New York, N. Y.	0.335
24	1⅝	150	4.50	2	190	4.50	Akron to Philadelphia, Pa.	0.315
27	2	224	6.50	2¼	265	6.50	Akron to Providence, R. I.	0.355
30	2⅛	252	7.20	2½	290	7.20	Akron to Buffalo, N. Y.	0.21
33	2¼	310	9.00	2⅝	335	9.00	Akron to Pittsburgh, Pa.	0.165
36	2½	350	10.25	2¾	375	10.25	Akron to Portland, Me.	0.355

The present discount on sewer pipe is approximately 50 per cent, varying somewhat according to the size of the pipe.

The list prices on fittings are four times the list price of the same sized pipe per foot up to 12 in. in diameter, *viz.:* the list price for an 8-in. pipe is 70 cts. per foot and for an 8-in. elbow $2.80. This applies only to curves, elbows, slants, reducers and increasers.

Wrought-iron Pipe—Genuine.—Genuine wrought-iron pipe for steam, gas and water is more expensive than steel pipe in first cost, but is worth the difference. Due to its resistance to corrosion and to its longer life, the cost of replacement is only a fraction of the similar cost for steel pipe.

The latest price list is given below. The present discount is as shown, but as this changes frequently, the latest discount sheet should be obtained for accurate estimating.

Byers Genuine Wrought-iron Pipe

Black and galvanized

Size	Standard					Extra strong				
	Diameters		Thickness	Pounds per foot	List price per foot	Diameters		Thickness	Pounds per foot	List price per foot
	External	Internal				External	Internal			
Butt weld										
¼	0.540	0.367	0.086	0.424	$0.06	0 540	0.295	0.122	0.535	$0.07½
⅜	0.675	0.489	0.093	0.567	0.06	0.675	0.417	0.129	0.738	0.07½
½	0.840	0.617	0.111	0.850	0.08½	0.840	0.539	0.151	1.087	0.11
¾	1.050	0.819	0.115	1.130	0.11½	1.050	0.735	0.157	1.473	0.15
1	1.315	1.043	0.136	1.678	0.17	1.315	0.949	0.183	2.171	0.22
1¼	1.660	1.369	0.145	2.272	0.23	1.660	1.269	0.195	2.996	0.30
1½	1.900	1.604	0.148	2.717	0.27½	1.900	1.491	0.204	3.631	0.36½
Lap weld										
1¼	1.660	1.369	0.145	2.272	0.23	1.660	1.269	0.195	2.996	0.30
1½	1.900	1.604	0.148	2.717	0.27½	1.900	1.491	0.204	3.631	0.36½
2	2.375	2.060	0.158	3.652	0.37	2.375	1.929	0.223	5.022	0.50½
2½	2.875	2.460	0.208	5.793	0.58½	2.875	2.311	0.282	7.661	0.77
3	3.500	3.059	0.221	7.575	0.76½	3.500	2.887	0.306	10.252	1.03
3½	4.000	3.538	0.231	9.109	0.92	4.000	3.350	0.325	12.505	1.25
4	4.500	4.016	0.242	10.790	1.09	4.500	3.811	0.344	14.983	1.50
4½	5.000	4.496	0.252	12.538	1.27	5.000	4.275	0.363	17.611	1.80
5	5.563	5.036	0.263	14.617	1.48	5.563	4.797	0.383	20.778	2.08
6	6.625	6.053	0.286	18.974	1.92	6.625	5.743	0.441	28.573	2.86
7	7.625	7.010	0.307	23.544	2.38	7.625	6.603	0.511	38.048	3.81
8	8.625	8.059	0.283	24.696	2.50	8.625	7.604	0.510	43.388	4.34
8	8.625	7.967	0.329	28.554	2.88					
9	9.625	8.927	0.349	33.907	3.45	9.625	8.604	0.510	48.728	4.90
10	10.750	10.181	0.284	31.201	3.20	10.750	9.729	0.510	54.735	5.48
10	10.750	10.124	0.313	34.240	3.50					
10	10.750	10.005	0.372	40.483	4.12					
11	11.750	10.985	0.382	45.557	4.63	11.750	10.729	0.510	60.075	6.10
12	12.750	12.077	0.336	43.773	4.50	12.750	11.729	0.510	65.415	6.55
12	12.750	11.985	0.382	49.562	5.07					

Genuine Wrought-iron Pipe

Discount to the trade—1923

Standard			Extra strong		
Sizes, inches	Black, per cent	Galvanized, per cent	Sizes, inches	Black, per cent	Galvanized, per cent
¼–⅜ butt	plus 44	plus 78	¼–⅜ butt	plus 54	plus 98
½ butt	less 4	plus 19	½ butt	plus 3	plus 21
¾ butt	less 11	plus 9	¾ butt	less 5	plus 15
1–1½ butt	less 14	plus 6	1–1½ butt	less 8	plus 12
2 lap	less 5	plus 14	2 lap	plus 1	plus 19
2½ lap	less 9	plus 9	2½–4 lap	less 6	plus 11
3–6 lap	less 11	plus 6	4½–6 lap	less 5	plus 12
7–12 lap	less 3	plus 16	7–8 lap	plus 3	plus 21
			9–12 lap	plus 10	plus 43

Standard Steam, Gas and Water Pipe

Black and galvanized

As adopted January 1, 1913

All weights and dimensions are nominal

Size, inches	List price per foot	Diameter, inches		Thickness, inches	Weight per foot, pounds		Number of threads per inch	Trade discount 1923
		External	Internal		Plain ends	Threaded and coupled		
⅛	$0.05½	0.405	0.269	0.068	0.244	0.245	27	23
¼	0.06	0 540	0.364	0.088	0.424	0.425	18	31
⅜	0.06	0.675	0.493	0.091	0.567	0.568	18	
½	0.08½	0.840	0.622	0.109	0.850	0.852	14	41
¾	0.11½	1.050	0.824	0.113	1.130	1.134	14	46
1	0.17	1.315	1.049	0.133	1.678	1.684	11½	
1¼	0.23	1.660	1.380	0.140	2.272	2.281	11½	
1½	0.27½	1.900	1.610	0.145	2.717	2.731	11½	48
2	0.37	2.375	2.067	0.154	3.652	3.678	11½	
2½	0.58½	2.875	2.469	0.203	5.793	5.819	8	
3	0.76½	3.500	3.068	0.216	7.575	7.616	8	
3½	0.92	4.000	3.548	0.226	9.109	9.202	8	
4	1.09	4.500	4.026	0.237	10.790	10.889	8	
4½	1.27	5.000	4.506	0.247	12.538	12.642	8	44
5	1.48	5.563	5.047	0.258	14.617	14.810	8	
6	1.92	6.625	6.065	0.280	18.974	19.185	8	
7	2.38	7.625	7.023	0.301	23.544	23.769	8	41
8	2.88	8.625	7.981	0.322	28.554	28.809	8	
9	3.45	9.625	8.941	0.342	33.907	34.188	8	35
10	4.12	10.750	10.020	0.365	40.483	41.132	8	
11	4.63	11.750	11.000	0.375	45.557	46.247	8	44
12	5.07	12.750	12.000	0.375	49.562	50 706	8	

The permissible variation in weight is 5 per cent above and 5 per cent below.

Furnished with threads and couplings and in random lengths, unless otherwise ordered.

For cut lengths, an extra charge will be made above random lengths.

For pipe smoothed on the inside, known as reamed and drifted, an extra charge will be made above standard pipe.

For galvanized or coated pipe, an extra charge will be made above black.

Lead Pipe

Weight per foot

	Extra light		Light		Medium		Strong		Extra strong		Double extra strong	
Size	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.
⅜	..	9	..	12	1	0	1	8	2	0	2	10
½	..	12	1	0	1	4	1	12	2	8	3	0
⅝	1	4	1	12	2	0	2	8	3	0	3	8
¾	1	8	2	0	2	4	3	0	3	8	4	0
⅞	2	0	2	8	3	0	3	8	..	..		
1	2	0	2	8	3	4	4	0	4	12	5	8
1¼	2	8	3	0	3	12	4	12	6	0	6	12
1½	3	8	4	0	5	0	6	0	7	8	9	0
1¾	3	12	4	8	5	8	6	8	8	0		
2	4	0	5	0	7	0	8	0	9	0	10	8
2½	..	..	6	0	8	0	11	0	14	0	17	0
3	4	12	6	3	9	0	12	0	16	0	20	0
3½	5	0	..	..	..	..	15	0	18	0		
4	6	0	8	0	10	0	16	0	21	0	25	0

BRASS, COPPER AND BRONZE PIPE

Seamless Brass Pipe

Iron pipe sizes—Regular and extra heavy

Net prices

Iron pipe size, inches	Outside diameter, inches	Regular inside diameter, inches	Thickness, inches	Weight per foot, pounds	Outside diameter, inches	Extra heavy		Weight per foot, pounds	Price per foot
						Inside diameter, inches	Thickness, inches		
⅛	0.405	0.281	0.062	0.246	0.405	0.205	0.100	0.353	$0.35
¼	0.540	0.375	0.083	0.437	0.540	0.294	0.123	0.593	0.32
⅜	0.675	0.494	0.090	0.612	0.675	0.421	0.127	0.805	0.29
½	0.840	0.625	0.107	0.911	0.840	0.542	0.149	1.191	0.27
¾	1.050	0.822	0.114	1.235	1.050	0.736	0.157	1.622	0.25
1	1.315	1.062	0.126	1.740	1.315	0.951	0.182	2.386	0.25
1¼	1.660	1.368	0.146	2.557	1.660	1.272	0.194	3.291	0.25
1½	1.900	1.600	0.150	3.037	1.900	1.494	0.203	3.986	0.25
2	2.375	2.062	0.157	4.017	2.375	1.933	0.221	5.508	0.25
2½	2.875	2.500	0.188	5.830	2.875	2.315	0.280	8.407	0.25
3	3.500	3.062	0.219	8.314	3.500	2.892	0.304	11.24	0.25
3½	4.0	3.500	0.250	10.85	4.0	3.358	0.321	13.66	0.25
4	4.500	4.0	0.250	12.29	4.500	3.818	0.341	16.41	0.25
4½	5.0	4.500	0.250	13.74	5.0	4.250	0.375	20.07	0.28
5	5.563	5.062	0.250	15.40	5.563	4.813	0.375	22.51	0.31
6	6.625	6.125	0.250	18.44	6.625	5.750	0.437	31.32	0.32

All stock lengths are 12 ft. Mill lengths run from 12 to 16 ft.

Seamless Copper and Bronze Pipe

Iron pipe sizes—Regular and extra heavy

Net prices

Iron pipe size, inches...	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½
Approximate weight, per lineal foot, regular thickness.....	0.259	0.459	0.644	0.958	1.298	1.829	2.689	3.193	4.224	6.130
Approximate weight, per lineal foot, extra heavy.....	0.371	0.624	0.847	1.253	1.706	2.509	3.460	4.191	5.791	8.839
Price per pound.....	0.37	0.34	0.31	0.29	0.25	0.25	0.25	0.25	0.25	0.25

The diameters and the thickness of regular and extra heavy copper pipe are the same as corresponding sizes of regular and extra heavy brass pipe.

All stock lengths are 12 ft. Mill lengths run from 12 to 16 ft.

PLUMBING

Time Required for A Mechanic and A Helper for the Various Plumbing Operations in Buildings

Erecting C.I. underground drains, less digging and backfilling; fittings at an average of every 10 ft.:

Number of Feet per 8 Hr.	
3 in. 60 ft.	6 in. 35 ft.
4 in. 50 ft.	8 in. 25 ft.
5 in. 40 ft.	

Erecting upright stacks of medium soil pipe; fittings at an average of every 10 ft.:

Number of Feet per 8 Hr.	
2 in. 70 ft.	5 in. 45 ft.
3 in. 60 ft.	6 in. 35 ft.
4 in. 50 ft.	8 in. 25 ft.

Erecting medium soil pipe back vent stack; fittings at an average of every 10 ft.:

Number of Feet per 8 Hr.		
2 in. 70 ft.	3 in. 60 ft.	4 in. 50 ft.

Erecting W.I. stacks of soil pipe for Durham System; fittings at an average of every 10 ft.:

Number of Feet per 8 Hr.		
4 in. 40 ft.	5 in. 35 ft.	6 in. 25 ft.

Erecting W.I. back vent pipe; fittings at an average of every 10 ft.:

1½ in. 70 ft.	3 in. 50 ft.
2 in. 65 ft.	4 in. 40 ft.
2½ in. 60 ft.	

Erecting upright stacks of galv. iron water pipe; fittings at an average of every 10 ft.:

Number of Feet per 8 Hr.		
¾ in. 120 ft.	1½ in. 70 ft.	3 in. 45 ft.
1 in. 100 ft.	2 in. 60 ft.	4 in. 35 ft.
1¼ in. 75 ft.	2½ in. 55 ft.	

Time for roughing in a 3-piece bathroom with all waste, hot and cold water and back vent complete, using C.I. soil pipe and G.I. pipe for hot and cold water, at an average distance from the stack of 3 ft.: 24 hr.—man and helper.

Time for setting up this bathroom with standard enamelled iron lavatory on brackets; standard enamelled iron bath, and low down closet combination: 15 hr.—man and helper.

Time for setting up the same bathroom with porcelain pedestal lavatory; porcelain bath, syphon W.C. with flushometer valve: 32 hr.—man and helper.

Time for roughing in the same bathroom, using Durham System: 30 hr.—man and helper.

Time for roughing in waste, hot and cold water and back vent for a kitchen or pantry sink, at an average of 10 ft. from the uprights: 12 hr.—man and helper.

Time for setting up this sink: 5 hr.—man and helper.

Time for roughing in of waste, back vent, hot and cold water, for one pair of wash tubs, at an average distance from the connections on the drain of 10 ft.: 14 hr.—man and helper.

Time for setting up this pair of wash tubs, from the floor line up: 10 hr.—man and helper.

Time for the roughing in of porcelain or enamelled iron slop sink and pedestal, 3-in. waste, hot and cold water and back vent, at an average distance from the upright stacks of 5 ft.: 12 hr.—man and helper.

Time for the setting of above from the floor line up: 6 hr.—man and helper.

All the above work is on the assumption that no other work interferes with the plumbing, that is, thimbles and sleeves are provided in concrete work in concrete construction, and that the cutting is done by others in wood construction.

GALVANIZED RANGE BOILER PRICES (NET)

Size in inches	Nominal capacity, gallons	Standard	Extra heavy
12 by 36	18	$ 7.07	$ 8.70
12 by 48	24	7.68	9.45
12 by 60	30	7.22	8.34
14 by 48	32	10.24	12.60
14 by 60	40	9.12	10.53
16 by 48	42	12.68	15.60
16 by 60	52	15.11	18.60
18 by 60	66	27.79	38.95
20 by 60	82	33.27	46.64
22 by 60	100	46.43	65.09
24 by 60	120	53.02	74.31
24 by 72	144	75.32	105.58
24 by 96	192	96.53	135.30

PLUMBING FIXTURES

The following illustrations with net prices to the trade are intended to give a general idea as to the cost of the average fixture. Better grades may be had in some fixtures, such as those manufactured by the Trenton Potteries Company, and also cheaper grades, such as plain cast-iron sinks.

A wall drinking fountain with a porcelain bowl fastened to the wall with a cast-iron bracket will cost about $28.

FIG. 2.—"Standard" Pembroke bath room.

Fixtures in this room consisting of corner bath, 5½ ft., with shower complete, lavatory 22 by 30 in., and water closet, cost $204.

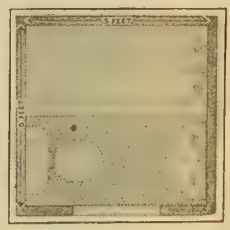


FIG. 3.—A "Standard" bathroom in a space five feet square.

Fixtures in this room consisting of recess bath, 5 ft., with shower complete, lavatory, 26 by 13 in., and water closet, cost $180.

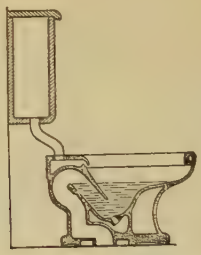


FIG. 4.—Cross section of "Standard" closet.

The combination shown has vitreous china tank and bowl, and white ivorite seat. Is equipped with valve on supply pipe so closet can be shut off if necessary, without shutting off water to other fixtures, $43.

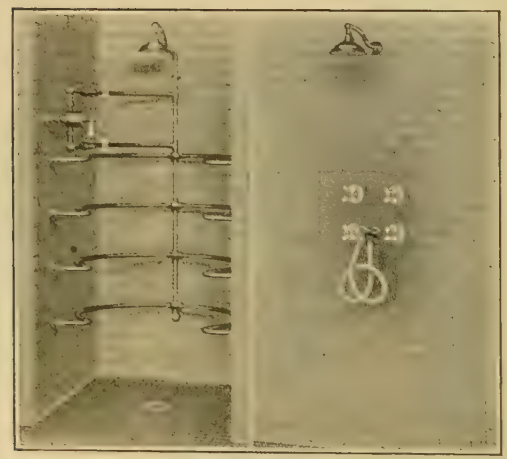
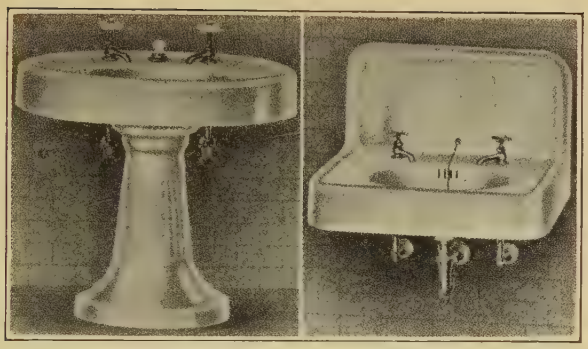


FIG. 5.—"Standard" head shower and needle bath, $135. Shower and shampoo, $21.



Lavatories.

FIG. 6. FIG. 7.

FIG. 6.—Is enameled, with oval top, and is made in two sizes. Has compression faucets with china handles, and indexes on top marked "Hot" and "Cold," and lift waste fitting with china knob. Supply pipes have valves below bowl with handles marked "Hot" and "Cold."

Size, 18 by 27 in..... $45.00
Size, 22 by 33 in..... $55.50

FIG. 7.—Is enameled, and the soap dish is cast in slab in the 17 by 21 in. and 18 by 24 in. sizes. It is furnished regularly with under side of slab and bowl painted white. It is supported on hanger and is equipped with faucets with handles marked "Hot" and "Cold," chain and rubber stopper, supply pipes and 1¼ in. trap.

Size, 17 by 21 in..... $16.50
Size, 18 by 24 in..... $18.60
Size, 20 by 24 in..... $21.25
Size, 22 by 27 in..... $30.00

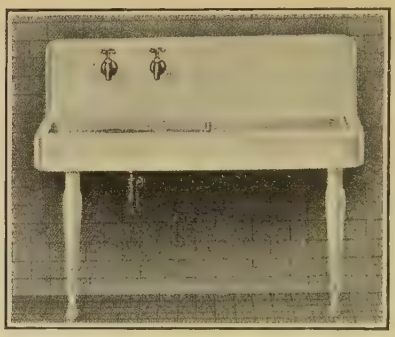


FIG. 8.—Kitchen sink. The back is 12 in. high, legs are enameled and are adjustable to set rim of sink 32 to 36 in. from the floor, except on 20 by 24 in. size, called "KITCHENETTE" pattern, which is supported on wall hangers only. The nickel-plated faucets marked "Hot" and "Cold" contain stream regulating device. Sink outlet has "Duplex" strainer with removable grating. Trap is nickel-plated.

Sink	20 in. wide, 24 in. long	20 in. wide, 30 in. long	22 in. wide, 36 in. long
Drain board	20 in. long	24 in. long	26 in. long
Length over all	42½ in.	52½ in.	60½ in.
Price	$31.00	$45.25	$54.00

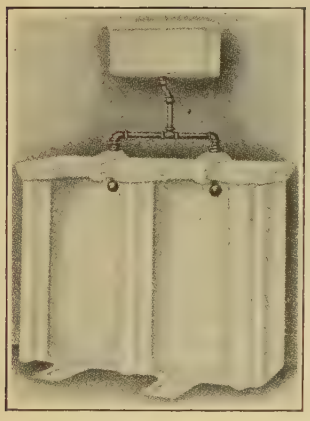


FIG. 9.

FIG. 10.

FIG. 9.—Porcelain urinal stalls with side slabs, floor slabs, front columns, low top pieces and seam covers, glazed white, vitreous china flush tank with automatic flushing fittings, nickel-plated brass spreaders, with flush connections and nickel-plated "T" connection and flush pipes to tank; nickel-plated urinal strainers and floor flanges. Height from floor to top of stalls, 40¾ in. Width over all: Two-stall, 5 ft.; three-stall, 7 ft.; four-stall, 9 ft. For every additional part, add 2 feet for over all dimensions.

Price two part as described $102

FIG. 10.—"Standard" Alta vitrite syphon jet urinal with No. 10 exposed N. P. metric junior push button valve, concealed lock shield controlling valve, N. P. inlet and brass outlet connections and N. P. wall bolts.

Price, without waste fittings or pipe $28.50

FIG. 11.—Enameled iron roll rim slop sink with 12-in. back in one piece, enameled full S trap standard with vent, nickel-plated fuller adjustable flange bibbs, concealed galvanized air chambers and nickel-plated strainer.

Sizes, inches, ...	16 by 20	18 by 22	20 by 22	20 by 24
Price, as described.....	$20.00	$28.60	$30.45	$33.00

FIG. 12.—Enameled iron roll rim laundry trays, tray and back of each section all in one piece, painted iron pedestals, nickel-plated union strips with hardwood wringer holders, nickel-plated soap dishes, nickel-plated fuller flanged bibbs, waste plugs with rubber stoppers, 1½-in. nickel-plated continuous waste and 1½-in. vented "S" trap.

Furnished regularly painted one coat outside.

Front to back. Inside, 21¾ in.; outside, 26 in. Depth inside, 14¼ in. Length over all, three sections, 83¼ in. Length inside, each section, 23 in.

Back, 8 in. Floor to top of rim, 31 in.

Price as described—three sections..... $112

FIG. 13.—Alberene stone laundry trays.

Width 24 in., depth 16 in., length 48 in. outside..... $26.40

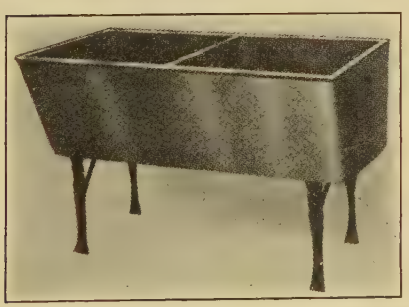


FIG. 14.—Cement laundry trays. These trays are made of gray cement with metal rim and fitted with cast iron collars, twin waste connections and brass waste plugs and overflows.

Two part 24 by 48 in..... $14.85

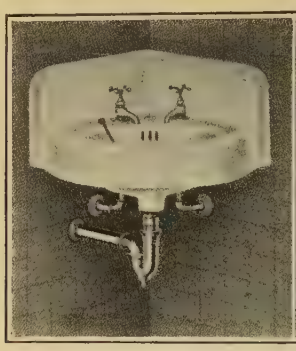


FIG. 15.

FIG. 16.

FIG. 15.—The "Standard" Verdun is a substantial and very simple enameled corner lavatory. It measures 16 in. on each side and is furnished regularly with soap dish cast in slab and under side of slab and bowl painted white. Supported on two concealed hangers and equipped complete with faucets marked "Hot" and "Cold," chain and rubber stopper, supply pipes and 1¼ in. trap, $16.50.

FIG. 16.—The "Standard" Vitreous China Hibben Lavatory. Hot and cold water enters through one opening. Supply pipes have valves below bowl and handles marked "Hot" and "Cold." Equipped with 1¼ in. trap.

Size, 18 by 20 in. $48.00
Size, 20 by 24 in. $57.70

SPRINKLER SYSTEMS

Due to the various requirements and methods of installation, it is impossible to give a unit price for sprinkler systems. The cost depends on the number and location of the risers, whether wet or dry system, the alarm valves, pumps, tanks, etc.

To give a general idea as to the cost of a complete installation, a few 1923 contract prices are given but these should not be used for estimating purposes:

Loft building, 8-story, 480 sprinkler heads, two tanks, one 10,100 gal., one 7,500 gal., compressor pump and alarm valves.....	$13,000
Factory, 1,137 heads, 25,000-gal. tank, city connection.....	19,500
Steam laundry, 500 heads.....	6,300
Bakery, 1,025 heads.....	21,000
Loft building, basement only, 1,051 heads.....	14,000

Fire Alarm, Automatic Electric.—The American Fire Prevention Bureau of New York is the owner of a patented automatic electrical fire alarm called the "Derby Fire Sentinel," working on a closed circuit. This can be installed with either exposed or concealed wir-

Fig. 17.

ing, the only exposed parts in the latter installation being the fusible discs. Equipments can be installed by competent electricians under their supervision and monthly inspection and a test may be made if desired. Four cents per square foot of ceiling area should cover the cost of the average installation.

CHAPTER XXIV

HEATING

Amount of Radiation Required.—There are a number of methods of determining the amount of radiation required for steam heating, but one that has been used a great deal in the northern states and has proved satisfactory is often spoken of as "200-20-2." It is easy to remember and to use. To determine the amount of radiation for a room, using low-pressure steam, the volume of the room in cubic feet is divided by 200; the net area of the exposed outside wall in square feet is divided by 20, and the area of the windows is divided by 2. By adding these together the amount of radiation required will be obtained. To illustrate: a room 16 by 16 by 10 ft. with an exposed wall 16 by 10 ft. and a window 3 by 5 ft. would be figured as follows:

$$\begin{aligned}
\text{Room} \quad & \frac{16 \times 16 \times 10}{200} && = 12.80 \\
\text{Wall} \quad & \frac{16 \times 10 - 3 \times 5}{20} && = 7.25 \\
\text{Window} \quad & \frac{3 \times 5}{2} && = 7.50 \\
& && \overline{27.55}
\end{aligned}$$

Taking the nearest even foot will give 28 sq. ft. of radiation, which will be sufficient for a properly constructed building. Additional radiation must be provided for special conditions, such as poor construction, unusual exposure, etc. When hot water is used instead of steam, about 45 per cent more radiation is required.

Size of Boiler Required.—A boiler should always be large enough to take care of the required radiation and the losses due to the piping, fittings, etc. The percentage to be added to the actual radiation is greater for small layouts than for large. The American Radiator Company gives the following: "A fair and dependable percentage of the Equivalent Column Radiation (Radiation only), plus Equivalent Column Radiation to take care of piping load and morning peak

load in selecting Boiler capacity may be figured as follows: Piping standing in air at 60 deg."

Equivalent Column Radiation Load

(Radiation only)

100 to	300 ft. plus 70 to 75 per cent
300 to	450 ft. plus 65 to 70 per cent
450 to	700 ft. plus 60 to 65 per cent
700 to	1,250 ft. plus 55 to 60 per cent
1,250 to	4,000 ft. plus 50 to 55 per cent
4,000 to	10,000 and over plus 50 per cent

Cost of Steam and Hot Water Heating.—The cost of a heating job is made up of the cost of the boiler, the radiators, pipe fittings and connections, insulation and labor for installing.

COST OF BOILERS AND RADIATORS[1]

Factory Shipments.—All prices quoted herein are f.o.b. Buffalo, with the actual carload rate of freight allowed on either carload or less than carload shipments, to any railroad point of destination where this rate does not exceed 30 cts. per 100 lb. Exceptions: No freight allowance will be made on repairs nor on shipment of less than 100 lb.

Warehouse Shipments.—No freight allowance will be made on shipment from branch warehouses. Boilers including repairs are regularly carried in stock at the New Haven warehouse and will be sold f.o.b. at such warehouse without freight allowance.

Prices Applying to Boilers for Different Sizes.—In order to make the sale of boilers more uniform throughout the year, the American Radiator Company have offered special inducements for purchases at certain times of the year. The year has been divided up into the following periods:

1st Period—February 1 to April 30, inclusive
2nd Period—May 1 to June 30, inclusive
3rd Period—July 1 to August 31, inclusive
4th Period—September 1 to November 30, inclusive
5th Period—December 1 to January 31, inclusive

The prices are lowest for the first period, advance about 2 per cent for the second period, about 5 per cent for the third period, 9 per cent for the fourth period and 7 per cent for the fifth above the rates for the first period.

[1] Courtesy American Radiator Company.

FIG. 1.—Ideal Arco boiler No. 6 Series.

IDEAL ARCO BOILERS

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight
		From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924				From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924	
		Net prices[1]	Net prices[1]				Net prices[1]	Net prices[1]	
No. 3 Series: Base, firepot (with crownsheet) and dome. Evaporative power, 8.0 lb.					No. 3 Series: Base, firepot (with crownsheet) and dome				
3-19-S	385	$123.85	$116.03	865	3-19-W	635	$ 93.74	$ 87.82	740
3-20-S	450	133.57	125.13	945	3-20-W	740	102.00	95 55	825
3-22-S	535	145.71	136.50	1,060	3-22-W	880	113.17	106 02	915
3-23-S	610	156 40	146.51	1,080	3-23-W	1,000	122.40	114.66	960
3-25-S	700	170 00	159.25	1,215	3-25-W	1,155	134 54	126 04	1,055
3-28-S	900	211.28	197 93	1,485	3-28-W	1,485	170.48	159 71	1,285
3-31-S	1,125	258.39	242.06	1,940	3-31-W	1,860	212.25	198 84	1,645
3-34-S	1,375	309.88	290.29	2,195	3-34-W	2.270	257.42	241.15	1,915
No. 4 Series: Base, firepot (with crownsheet) single section and dome. Evaporative power 8.5 lb.					No. 4 Series: Base, firepot (with crownsheet) single section and dome				
4-19-S	410	139.40	130.59	975	4-19-W	675	109.28	102.38	850
4-20-S	480	150.08	140.60	1,055	4-20-W	790	119 48	111.93	935
4-22-S	570	163.68	153.34	1,170	4-22-W	940	132.11	123.76	1,035
4-23-S	650	175.82	164.71	1,215	4-23-W	1,065	142.31	133.32	1,085
4-25-S	750	190.88	178.82	1,365	4-25-W	1,240	157.85	147.88	1,220
4-28-S	965	238.96	223.86	1,680	4-28-W	1,590	200.11	187.46	1,485
4-31-S	1,200	291.42	273.00	2,215	4-31-W	1,980	247 71	232.05	1,895
4-34-S	1,465	350.68	328.51	2,475	4-34-W	2,415	300.65	281.65	2,220

[1] No additional charge will be made for safety valves or boxing.

Ideal Arco Boilers.—(*Continued*)

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated: From Dec. 1, 1923 to Jan. 31, 1924 — Net prices[1]	From Feb. 1, to Apr. 30, 1924 — Net prices[1]	Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated: From Dec. 1, 1923 to Jan. 31, 1924 — Net prices[1]	From Feb. 1, to Apr. 30, 1924 — Net prices[1]	Approximate shipping weight
No. 5 Series: Base, firepot (with crownsheet) double section and dome. Evaporative power 9.0 lb.					No. 5 Series: Base, firepot (with crownsheet) double section and dome				
5-19-S	430	152.02	142.42	1,065	5-19-W	710	119.97	112.39	930
5-20-S	500	163.68	153 34	1,135	5-20-W	825	131.14	122.85	1,030
5-22-S	600	180.19	168.81	1,275	5-22-W	990	146.20	136.96	1,155
5-23-S	685	194.28	182.00	1,340	5-23-W	1,130	158.82	148.79	1,205
5-25-S	800	213.22	199.75	1,525	5-25-W	1,320	176.79	165.62	1,360
5-28-S	1,025	266.16	249 34	1.865	5-28-W	1,690	225.36	211.12	1,670
5-31-S	1,275	324 93	304 40	2,365	5-31-W	2,100	279 28	261 63	2,150
5-34-S	1,550	389 53	364.91	2,740	5-34-W	2,555	338.53	317.14	2,485
No. 6 Series: Base, firepot (with crownsheet) double section, single section dome. Evaporative power 9.4 lb.					No. 6 Series: Base, firepot (with crownsheet) double section, single section and dome				
6-19-S	450	168.05	157.43	1,185	6-19-W	740	136.00	127.40	1,050
6-20-S	520	180.68	169 26	1,255	6-20-W	860	147.65	138.32	1,135
6-22-S	630	199.14	186 55	1,400	6-22-W	1,040	166 11	155.61	1,275
6-23-S	715	213.71	200 20	1,495	6-23-W	1,180	180.19	168.81	1,320
6-25-S	835	234 11	219.31	1,680	6-25-W	1,375	200.11	187 46	1,530
6-28-S	1,070	292 88	274 37	2,060	6-28-W	1,765	254.51	238 42	1,875
6-31-S	1,330	357 96	335 34	2,630	6-31-W	2,195	315.22	295 30	2,430
6-34-S	1,615	428.87	401.77	3,030	6-34-W	2,665	380 79	356.72	2,770

[1] No additional charge will be made for safety valves or boxing.

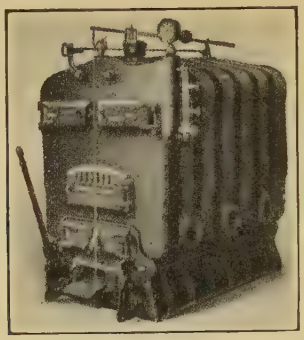


FIG. 2.—Ideal sectional 25-in. boiler.

IDEAL SECTIONAL BOILERS

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight
		From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924				From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924	
		Net prices[1]	Net prices[1]				Net prices[1]	Net prices[1]	
S-19- 5	600	$ 188.06	$ 176.17	1,875	W-19- 5	1,000	$ 166.13	$ 155.63	1,770
S-19- 6	750	219 26	205 40	2,195	W-19- 6	1,250	196.49	184.07	2,065
S-19- 7	900	250.46	234 63	2,595	W-19- 7	1,500	226 85	212.51	2,370
S-22- 5	800	229.38	214.88	2,290	W-22- 5	1,300	203.24	190.39	2,160
S-22- 6	1,000	270.70	253.59	2,675	W-22- 6	1,650	245 40	229.89	2,560
S-22- 7	1,200	312.02	292.30	3,075	W-22- 7	2,000	287.57	269.39	2,935
S-25- 5	1,100	291.78	273 34	3,000	W-25- 5	1,825	266.48	249.64	2,855
S-25- 6	1,350	343.22	321 53	3,500	W-25- 6	2,225	315.39	295.46	3,335
S-25- 7	1,600	395.51	370.51	4,035	W-25- 7	2,650	366 84	343.65	3,850
S-25- 8	1,850	435.99	408.43	4.720	W-25- 8	3,050	402.25	376 83	4,300
S-28- 5	1,300	333.10	312.05	3.405	W-28- 5	2,150	306.12	286.77	3,250
S-28- 6	1,625	399 72	374.46	4,005	W-28- 6	2,675	369.37	346.02	3,840
S-28- 7	1,950	452.01	423 44	4,585	W-28- 7	3,200	415.75	389 47	4,420
S-28- 8	2,275	504 29	472.42	5,205	W-28- 8	3,725	462.13	432.92	4,990

[1] No additonal charge will be made for safety valves or boxing.

Ideal Sectional Boilers.—(*Continued*)

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight
		From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924				From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924	
		Net prices[1]	Net prices[1]				Net prices[1]	Net prices[1]	
S-48- 6	5,275	1,053.28	986.71	10,225	W-48- 6	8,700	1,028.83	963.80	10,230
S-48- 7	6,300	1,213.51	1,136.81	11,725	W-48- 7	10,375	1,183.15	1,108.37	11,700
S-48- 8	7,325	1,373.74	1,286.91	13,215	W-48- 8	12,050	1,337.47	1,252.94	13,200
S-48- 9	8,350	1,533.96	1,437.01	14,770	W-48- 9	13,725	1,491.80	1,397.51	14,730
S-48-10	9,375	1,694.19	1,587.11	16,310	W-48-10	15,400	1,646.12	1,542.08	16,300
With Ideal smoke preventing device					With Ideal smoke preventing device				
T-48- 6	5,275	1,083.64	1,015.15	10,545	T-48- 60	8,700	1,059.18	992.24	10,520
T-48- 7	6,300	1,243.87	1,165.25	12,055	T-48- 70	10,375	1,213.51	1,136.81	12,030
T-48- 8	7,325	1,404.09	1,315.35	13,555	T-48- 80	12,050	1,367.83	1,281.38	13,530
T-48- 9	8,350	1,564.32	1,465.45	15,085	T-48- 90	13,725	1,522.16	1,425.95	15,060
T-48-10	9,375	1,724.55	1,615.55	16,560	T-48-100	15,400	1,676.48	1,570.52	16,535
T-48-11	10,400	1,884.78	1,765.65	18,010	T-48-110	17,075	1,830.80	1,715.09	17,985
T-48-12	11,425	2,045.00	1,915.75	19,290	T-48-120	18,750	1,985.13	1,859.66	19,265

[1] No additional charge will be made for safety valves or boxing.

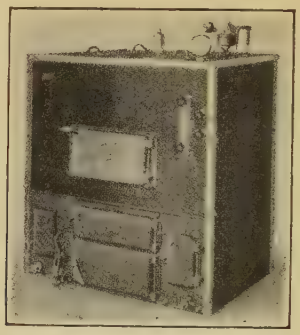


FIG. 3.—Ideal Type "A" boiler.

IDEAL TYPE "A" BOILERS

(With metallic jacket)

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight
		From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924				From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924	
		Net prices[1]	Net prices[1]				Net prices[1]	Net prices[1]	
1-A- 4	450	$ 337.90	$ 316.52	2,145	1-A- 40	750	$ 312.52	$ 292.74	2,090
1-A- 5	600	386.93	362.44	2,430	1-A- 50	1,000	361.54	338.66	2,415
1-A- 6	750	435.95	408.36	2,715	1-A- 60	1,250	410.56	384.58	2,710
1-A- 7	900	484.97	454.28	3,040	1-A- 70	1,500	459.59	430.50	3,025
2-A- 5	1,100	531.28	497.70	3,725	2-A- 50	1,800	505.98	474.00	3,740
2-A- 6	1,400	602.12	564.06	4,245	2-A- 60	2,300	576.82	540.36	4,235
2-A- 7	1,700	672.95	630.42	4,745	2-A- 70	2,800	647.65	606.72	4,720
2-A- 8	2,000	743.79	696.78	5,230	2-A- 80	3,300	718.49	673.08	5,200
2-A- 9	2,300	814.63	763.14	5,710	2-A- 90	3,800	789.33	739.44	5,705
3-A- 5	2,600	1,019.55	955.11	7,420	3-A- 50	4,400	990.88	928.25	7,470
3-A- 6	3,250	1,173.87	1,099.68	8,525	3-A- 60	5,500	1,145.20	1,072.82	8,555
3-A- 7	3,900	1,328.20	1,244.25	9,685	3-A- 70	6,600	1,299.53	1,217.39	9,715
3-A- 8	4,550	1,482.52	1,388.82	10,750	3-A- 80	7,700	1,453.85	1,361.96	10,805
3-A- 9	5,200	1,636.85	1,533.39	11,915	3-A- 90	8,800	1,608 17	1,506.53	11,975
3-A-10	5,850	1,791.17	1,677.96	13,050	3-A-100	9,900	1,762.50	1,651.10	13,115
3-A-11	6,500	1,945.49	1,822.53	14,085	3-A-110	11,000	1,916.82	1,795.67	14,155

[1] No additional charge will be made for safety valves or boxing.

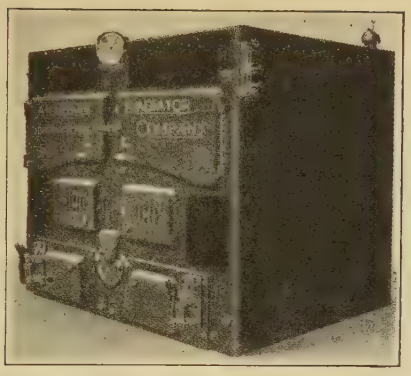


FIG. 4.—Ideal water tube boiler.

IDEAL WATER TUBE BOILERS

(With metallic jacket)

(Without Ideal smoke preventing device)

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight
		From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924				From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924	
		Net prices[1]	Net prices[1]				Net prices[1]	Net prices[1]	
S-23-T- 5	600	$ 280.28	$ 262.55	1,885	W-23-T- 5	975	$ 252.73	$ 236.74	1,770
S-23-T- 6	750	318.28	298.15	2,115	W-23-T- 6	1,200	288.83	270.56	1,990
S-23-T- 7	900	356.29	333.75	2,390	W-23-T- 7	1,425	324.93	304.38	2,280
S-23-T- 8	1,050	394.29	369.35	2,630	W-23-T- 8	1,650	361.04	338.20	2,490
S-23-T- 9	1,200	437.05	409.40	2,950	W-23-T- 9	1,875	397.14	372.02	2,735
S-29-T- 5	1,200	422.49	395.79	3,225	W-29-T- 5	1,920	390 45	365.77	3,060
S-29-T- 6	1,500	490.80	459.78	3,720	W-29-T- 6	2,400	453.70	425.02	3,565
S-29-T- 7	1,800	559.11	523.77	4,210	W-29-T- 7	2,880	516.94	484.27	4,050
S-29-T- 8	2,100	627.42	587.76	4,705	W-29-T- 8	3,360	580.19	543.52	4,480
S-29-T- 9	2,400	695.72	651.75	5,265	W-29-T- 9	3,840	643.44	602.77	4,875
S-29-T-10	2,700	764.03	715.74	5,770	W-29-T-10	4,320	706.69	662.02	5,405

[1] No additional charge will be made for safety valves or boxing.

Ideal Water Tube Boilers.—(*Continued*)

(With metallic jacket)
(Without Ideal smoke preventing device)

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight
		From Dec. 1, 1923 to Jan 31, 1924	From Feb. 1, to Apr. 30, 1924				From Dec 1, 1923 to Jan 31, 1924	From Feb 1, to Apr. 30, 1924	
		Net prices[1]	Net prices[1]				Net prices[1]	Net prices[1]	
S-79-T- 7	7,000	1,963.35	1,839.20	15,850	W-79-T- 7	11,550	1,983.63	1,858.20	16,111
S-79-T- 8	8,000	2,149.95	2,014.00	17,546	W-79-T- 8	13,200	2,166.17	2,029.20	17,808
S-79-T- 9	9,000	2,336.54	2,188.80	19,233	W-79-T- 9	14,850	2,348.71	2,200.20	19,494
S-79-T-10	10,000	2,523.14	2,363.60	20,881	W-79-T-10	16,500	2,531.26	2,371.20	21,142
S-79-T-11	11,000	2,709.74	2,538.40	22,794	W-79-T-11	18,150	2,713.80	2,542.20	23,055
S-79-T-12	12,000	2,896.34	2,713.20	24,461	W-79-T-12	19,800	2,896.34	2,713.20	24,723
S-79-T-13	13,000	3,062.66	2,869.00	25,968	W-79-T-13	21,450	3,054.54	2,861.40	26,230
S-79-T-14	14,000	3,228.97	3,024.80	27,638	W-79-T-14	23,100	3,212.75	3,009.60	27,899
S-79-T-15	15,000	3,395.29	3,180.60	29,178	W-79-T-15	24,750	3,370.95	3,157.80	29,410

[1] No additional charge will be made for safety valves or boxing.

Ideal Water Tube Boilers

(With metallic jacket)

(With Ideal smoke preventing device)

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight
		From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924				From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924	
		Net prices[1]	Net prices[1]				Net prices[1]	Net prices[1]	
T-23- 9	1,200	$ 448 45	$ 420.08	3,045	T-23- 90	1,875	$ 408.54	$ 382.70	2,845
T-23-10	1,350	486.45	455.68	3,310	T-23-100	2,100	444.65	416.52	3,015
T-23-11	1,500	524.46	491.28	3,475	T-23-110	2,325	480.75	450.34	3,240
T-29- 7	1,800	572.60	536.41	4,410	T-29- 70	2,880	530.44	496.91	4,100
T-29- 8	2,100	640 91	600 40	4,795	T-29- 80	3,360	593.68	556.16	4,570
T-29- 9	2,400	709 22	664 39	5,290	T-29- 90	3,840	656.93	615.41	4,985
T-29-10	2,700	777 52	728.38	5,805	T-29-100	4,320	720.18	674.66	5,485
T-29-11	3,000	845.83	792.37	6,340	T-29-110	4,800	783.43	733.91	5,990
T-79- 9	9,000	2,369.00	2,219.20	20,094	T-79- 90	14,850	2,381.17	2,230.60	20,356
T-79-10	10,000	2,555.60	2,394.00	21,753	T-79-100	16,500	2,563.71	2,401.60	22,014
T-79-11	11,000	2,742.19	2,568 80	23,412	T-79-110	18,150	2,746.25	2,572.60	23,673
T-79-12	12,000	2,928.79	2,743.60	25,091	T-79-120	19,800	2,928.79	2,743.60	25,353
T-79-13	13,000	3,095.11	2,899.40	26.599	T-79-130	21,450	3,087.00	2,891.80	26,861
T-79-14	14,000	3,261.43	3,055.20	28,235	T-79-140	23,100	3,245.20	3,040.00	28,496
T-79-15	15,000	3,427.74	3,211.00	29.775	T-79-150	24,750	3,403.40	3,188.20	30,036

[1] No additional charge will be made for safety valves or boxing.

Ideal Water Tube Boilers

(Without metallic jacket)

(Without Ideal smoke preventing device)

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the various delivery periods as indicated		Approximate shipping weight
		From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924				From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924	
		Net prices[1]	Net prices[1]				Net prices[1]	Net prices[1]	
S-23-T- 5	600	$ 261.28	$ 244.75	1,805	W-23-T- 5	975	$ 233.72	$ 218 94	1,695
S-23-T- 6	750	294.53	275.90	2,015	W-23-T- 6	1,200	265 08	248.31	1,890
S-23-T- 7	900	327.78	307.05	2,270	W-23-T- 7	1,425	296.43	277.68	2,160
S-23-T- 8	1,050	361.04	338.20	2,490	W-23-T- 8	1,650	327.78	307 05	2,350
S-23-T- 9	1,200	399.04	373.80	2,785	W-23-T- 9	1,875	359.14	336.42	2,570
S-29-T- 5	1,200	397.19	372.09	3,095	W-29-T- 5	1,920	365 15	342.07	2,935
S-29-T- 6	1,500	457.91	428.97	3,565	W-29-T- 6	2,400	420.81	394 21	3,405
S-29-T- 7	1,800	518.63	485.85	4,020	W-29-T- 7	2,880	476.46	446.35	3,860
S-29-T- 8	2,100	579.35	542.73	4,480	W-29-T- 8	3,360	532.12	498.49	4,260
S-29-T- 9	2,400	640 06	599.61	5,015	W-29-T- 9	3,840	587.78	550.63	4,620
S-29-T-10	2,700	700.78	656.49	5,485	W-29-T-10	4,320	643.44	602.77	5,120
S-36-T- 5	1,750	419.96	393.42	4,105	W-36-T- 5	2,875	387.07	362.61	4,115
S-36-T- 6	2,200	491.64	460 57	4,735	W-36-T- 6	3,600	451.17	422.65	4,730
S-36-T- 7	2,650	564.17	528.51	5,375	W-36-T- 7	4,325	515 26	482.69	5,380
S-36-T- 8	3,100	635.85	595 66	6,020	W-36-T- 8	5,050	580.19	543.52	5,950
S-36-T- 9	3,550	708 37	663 60	6,570	W-36-T- 9	5,775	644 28	603.56	6,570
S-36-T-10	4,000	780.05	730 75	7,185	W-36-T-10	6,500	709 22	664.39	7,130
S-36-T-11	4,450	852.58	798 69	7,875	W-36-T-11	7,225	773.31	724.43	7,860
S-36-T-12	4,900	924.26	865.84	8,485	W-36-T-12	7,950	838.24	785.26	8.485
S-79-T- 7	7,000	1,825.43	1,710.00	15,331	W-79-T- 7	11,550	1,845.71	1,729.00	15,592
S-79-T- 8	8,000	1,995.80	1,869.60	16,957	W-79-T- 8	13,200	2,012.02	1,884.80	17,218
S-79-T- 9	9,000	2,166.17	2,029.20	18,575	W-79-T- 9	14,850	2,178.34	2,040.60	18,836
S-79-T-10	10,000	2,336.54	2,188 80	20,163	W-79-T-10	16,500	2,344.66	2,196.40	20,425
S-79-T-11	11,000	2,506.92	2,348.40	22,054	W-79-T-11	18,150	2,510.97	2,352.20	22,315
S-79-T-12	12,000	2,677.29	2,508.00	23,659	W-79-T-12	19,800	2,677.29	2,508.00	23,920
S-79-T-13	13,000	2,827.38	2,648 60	25.113	W-79-T-13	21,450	2,819.27	2,641.00	25,375
S-79-T-14	14,000	2,977.47	2,789.20	26,734	W-79-T-14	23,100	2,961.25	2,774.00	26,995
S-79-T-15	15,000	3,127.56	2,929.80	28,194	W-79-T-15	24,750	3,103.22	2,907.00	28,455

[1] No additional charge will be made for safety valves or boxing.

Ideal Water Tube Boilers
(Without metallic jacket)
(With Ideal smoke preventing device)

Steam					Water				
Boiler number steam	Rating square feet	The following net prices will apply to boilers ordered shipped in the delivery periods as indicated		Approximate shipping weight	Boiler number water	Rating square feet	The following net prices will apply to boilers ordered shipped in the delivery periods as indicated		Approximate shipping weight
		From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924				From Dec. 1, 1923 to Jan. 31, 1924	From Feb. 1, to Apr. 30, 1924	
		Net prices[1]	Net prices[1]				Net prices[1]	Net prices[1]	
T-23- 9	1,200	$ 410.44	$ 384.48	2,885	T-23- 90	1,875	$ 370.54	$ 347.10	2,680
T-23-10	1,350	443 70	415 63	3,125	T-23-100	2,100	401.89	376 47	2,830
T-23-11	1,500	476.95	446.78	3,270	T-23-110	2,325	433.25	405.84	3,035
T-29- 7	1,800	532.12	498.49	4,220	T-29- 70	2,880	489.96	458.99	3,910
T-29- 8	2,100	592 84	555.37	4,575	T-29- 80	3,360	545 62	511.13	4,345
T-29- 9	2,400	653 56	612 25	5,040	T-29- 90	3,840	601.27	563.27	4,735
T-29-10	2,700	714.28	669 13	5,520	T-29-100	4,320	656 93	615 41	5,205
T-29-11	3,000	774.99	726 01	6,025	T-29-110	4,800	712 59	667.55	5,575
T-36- 8	3,100	648.50	607.51	6,165	T-36- 80	5,050	592.84	555.37	6,115
T-36- 9	3,550	721 02	675 45	6,705	T-36- 90	5,775	656.93	615.41	6,680
T-36-10	4,000	792 70	742.60	7,355	T-36-100	6,500	721.86	676.24	7,360
T-36-11	4,450	865.23	810.54	8,045	T-36-110	7,225	785.96	736.28	7,970
T-36-12	4,900	936.91	877 69	8,650	T-36-120	7,950	850.89	797.11	8,585
T-79- 9	9,000	2,198.62	2,059.60	19,436	T-79- 90	14,850	2,210.79	2,071.00	19,697
T-79-10	10,000	2,369.00	2,219 20	21,035	T-79-100	16,500	2,377.11	2,226.80	21,296
T-79-11	11,000	2,539 37	2,378 80	22,672	T-79-110	18,150	2,543 43	2,382.60	22,934
T-79-12	12,000	2,709.74	2,538.40	24,289	T-79-120	19,800	2,709.74	2,538.40	24,550
T-79-13	13,000	2,859.83	2,679.00	25,745	T-49-130	21,450	2,851.72	2,671 40	26,006
T-79-14	14,000	3,009.92	2,819 60	27,331	T-79-140	23,100	2,993.70	2,804 40	27,592
T-79-15	15,000	3,160.01	2,960.20	28,791	T-79-150	24,750	3,135.67	2,937.40	29,052

[1] No additional charge will be made for safety valves or boxing.

BOILER SUNDRIES

Trimmings.—Regular trimmings, including safety valves are supplied with all steam boilers with no additional charge.

Safety Valves.—These valves, conforming in size to the requirements of the code of the American Society of Mechanical Engineers,

will be furnished with all steam boilers at no additional charge. Nickel plated safety valves are furnished with Type *A* and with gas steam boilers.

Water Regulators.—No. 800 Arco Water Regulators (for damper control) are supplied with water boilers upon order only at an additional charge of $12 net. No. 800 Arco Water Regulator, No. 540 Straight Thermometer and No. 578 Altitude Gauge are supplied regularly with each gas water boiler without extra charge.

Fire Tools.—Firing tools will be supplied with all boilers (except hot water supply boilers).

Draw-off Cock.—Draw-off Cocks are furnished upon order only and at an additional charge as indicated on Specialties Discount Sheet. Nickel plated Draw-off Cocks are regularly furnished with Type "*A*" and Gas Boilers without extra charge.

Tappings.—An extra charge of 75 cts. net will be made for additional tappings or any change in the size or the number of the tappings of Ideal Boilers without Jackets, from those shown in the "Ideal Fitter" catalogue. Arco, Type *A*, 23-in. and 29-in. Water Tube Boilers are furnished with tappings for External Water Heaters. All other types of boilers are furnished with blank bosses and can be tapped when orders so specify, at no extra charge.

Bushings.—Additional plugs or bushings, or plugs or bushings of sizes other than those regularly furnished, will be charged for at regular prices.

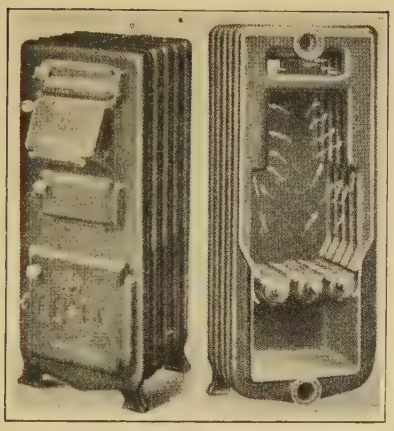


FIG. 5.—Ideal-arcola radiator boiler.

IDEAL-ARCOLA RADIATOR BOILER OUTFITS

Arcola outfits (for all fuels except gas)				Gas-Arcola outfits (for artificial and natural gas)			
Outfit number	From Sept. 1 to Nov. 30, 1923	From Dec. 1 to Dec. 31, 1923	Approximate shipping weight	Outfit number	From Sept. 1 to Nov. 30, 1923	From Dec. 1 to Dec. 31, 1923	Approximate shipping weight
	Net prices	Net prices			Net prices	Net prices	
1-PA- 75	$ 89.25	$ 88.72	985	1-GA- 75	$103.88	$103.35	900
1-PA-100	99.94	99.24	1,160	1-GA-100	114.56	113.86	1,075
1-PA-125	110.62	109.75	1,335	1-GA-125	125.25	124.38	1,250
1-PA-150	121.32	120.27	1,510	1-GA-150	135.94	134.89	1,425
2-PA-175	139.69	138.46	1,750	2-GA-175	154.69	153.46	1,645
2-PA-200	150.38	148.98	1,925	2-GA-200	165.38	163.98	1,820
2-PA-225	161.06	159.49	2,100	2-GA-225	176.06	174.49	1,995
3-PA-250	179.44	177.69	2,350	3-GA-250	198.38	196.63	2,230
3-PA-275	190.13	188.20	2,525	3-GA-275	209.07	207.14	2,405
3-PA-300	200.81	198.71	2,700	3-GA-300	219.75	217.65	2,580
4-PA-325	219.19	216.92	2,945	4-GA-325	236 06	233.79	2,810
4-PA-350	229.88	227.43	3,120	4-GA-350	246.76	244.31	2,985
4-PA-375	240.57	237.94	3,295	4-GA-375	257.44	254.81	3,160
5-PA-400	258.00	255.20	3,535	5-GA-400	273.00	270.20	3,395
5-PA-425	268.69	265.72	3,710	5-GA-425	283.69	280.72	3,570
5-PA-450	279.38	276.23	3,885	5-GA-450	294.38	291.23	3,745

Prices include Ideal-Arcola boiler, as indicated by first figure in outfit number; regular 38-in. high American Peerless 3-column water radiation (quantity as specified by the last figure in the outfit number following the letters PA or GA); Arcola expansion tank and water gauge, ¾-in. drain cock and vent fitting. Radiation will be made up in any number of radiators desired. Any additional quantity of radiation will be furnished at extra charge, as per current Trade Discount Sheet. No radiator valves or air valves are necessary but will be furnished, if desired, at current trade prices.

Ideal-Arcola boiler singly						Ideal-Arcola outfit parts			
Ideal Arcola	Net trade price	Shipping weight	Gas Arcola	Net trade price	Shipping weight	Arcola adjuncts	Net trade price	Arcola ashpans	Net trade price
No. 0 PA	$45.50	375	No. 0 GA	$58.25	312	Arcola expansion tank	$4.25	No. 0	$0.95
No. 1 PA	53.00	445	No. 1 GA	65.25	354	Expansion tank trimmings	1.25	No. 1	1.00
No. 2 PA	60.50	515	No. 2 GA	73.25	399	Arcola drain cock	0.95	No. 2	1.05
No. 3 PA	68.00	585	No. 3 GA	84.75	463	Overflow fitting	0.25	No. 3	1.15
No. 4 PA	75.50	655	No. 4 GA	90.50	518	Poker 24 in.	0.20	No. 4	1.20
No. 5 PA	83.00	725	No. 5 GA	95.25	575	Poker 30 in.	0.20	No. 5	1.25

Ideal-Arcola Hot Water Supply Outfits

Arcola outfits (for all fuels except gas)

Outfit number	Ideal Arcola boiler	Tank capacity	Advertised package price to public	Net price to heating trade	Approximate shipping weight
00-52 Black	No. 0	52-Gal. Black	$105.00	$ 78.75	570
01-100 Black	No. 1	100-Gal. Black	142.50	106.88	760
00-52 Galv.	No. 0	52-Gal. Galv.	108.50	81.38	580
01-100 Galv.	No. 1	100-Gal. Galv.	163.00	122.25	760

Complete outfits tested to 200-lb. pressure.

Prices include Ideal-Arcola boiler, either galvanized or black steel, extra heavy storage tank, Arcola automatic water regulator stand for tank, ¾-in. drain cock, and necessary pipe and fittings cut ready to be assembled.

Gas-Arcola Outfits

(For artificial and natural gas)

Outfit number	Ideal Arcola boiler	Tank capacity	Advertised package price to public	Net price to heating trade	Approximate shipping weight
0-Gas-52 Black	No. 0	52-Gal. Black	$137.50	$103.13	530
1-Gas-100 Black	No. 1	100-Gal. Black	178.00	133.50	680
0-Gas-52 Galv.	No. 0	52-Gal. Galv.	141.00	105.75	530
1-Gas-100 Galv.	No. 1	100-Gal. Galv.	198.50	148.88	680

Complete outfits tested to 200-lb. pressure.

Prices include Ideal-Arcola gas boiler either galvanized or black steel extra heavy storage tank, Arco water regulator, Arco snap-acting gas valve, stand for tank, ¾-in. drain cock, and necessary pipe and fittings cut ready to be assembled.

IDEAL-ARCOLA GARAGE HEATING OUTFITS

Arcola outfits (for all fuels except gas)

Outfit number	From Mar. 19 to Apr. 30, 1923	From May 1 to June 30, 1923	From July 1 to Aug. 31, 1923	From Sept. 1 to Nov. 30, 1923	From Dec. 1 to Dec. 31, 1923	Approximate shipping weight
	Net prices	Net prices	Net prices	Net prices	Net prices	
0-36	$75.37	$75.73	$76.19	$ 76.71	$74.44	695
0-72	91.10	91.82	92.75	93.78	93.24	945
1-36	81.74	82.10	82.56	83.08	82.81	760
1-72	97.47	98.19	99.12	100.15	99.61	1,015

Prices include Ideal-Arcola boiler, four or eight sections American Peerless wall radiation, Arcola automatic water regulator, expansion tank, ¾-in. drain cock, and necessary pipe and fittings cut ready to be assembled.

GAS-ARCOLA OUTFITS

(For artificial and natural gas)

Outfit number	From Mar. 19 to April 30, 1923	From May 1 to June 30, 1923	From July 1 to Aug. 31, 1923	From Sept. 1 to Nov. 30, 1923	From Dec. 1 to Dec. 31, 1923	Approximate shipping weight
	Net prices	Net prices	Net prices	Net prices	Net prices	
0-Gas-40	$100.88	$101.25	$101.72	$102.23	$101.95	660
1-Gas-75	122.92	123.60	124.49	125.44	124.91	925

Prices include Ideal-Arcola gas boiler, one American Peerless 38-in. high 3-column radiator, Arco water regulator, Arco snap-acting gas valve, expansion tank, ¾-in. drain cock, and necessary pipe and fittings cut ready to be assembled.

NOTE.—Arcola garage outfits assembled with No. 0 Arcola boilers are recommended for hard coal only. Where bituminous coal is used, outfits assembled with No. 1 Arcola boilers should be installed. If Arcola boilers larger than No. 1 are desired, same can be supplied on special order at an extra charge of $7.50 for each size larger than the boiler specified.

IDEAL-ARCOLA OUTFITS

Freight Terms.—All prices quoted herein are f.o.b. Buffalo, N. Y., with the actual carload rate of freight only allowed, on either carload

or less than carload shipments, to any railroad point of destination where this rate does not exceed 30 cts. per 100 lb.

Exceptions: No freight allowance will be made on repairs nor on shipments of less than 100 lb.

Factory Shipments.—On shipments of radiator-boiler outfits from Detroit, Litchfield, Titusville, Bremen or Bayonne, the actual carload rate of freight only will be allowed on either carload or less than carload shipments to any railroad point of destination where said rate does not exceed 20 cts. per 100 lb. On shipments of garage outfits from Bremen the actual carload rate of freight only will be allowed on either carload or less than carload shipments, to any railroad point of destination, where said rate does not exceed 10 cts. per 100 lb.

Warehouse Shipments.—No freight allowance will be made on shipments from branch warehouses. Arcola outfits or Arcola boilers singly, regularly carried in stock at branch warehouses, will be sold f.o.b. such warehouses. Exceptions: An added charge for freight, as indicated, will be made on shipments, including repairs, from the following warehouses:

Richmond—All shipments from Richmond warehouse will be invoiced at prices 5 per cent higher than those herein indicated.

Des Moines—Radiator boiler outfits, 10 cts. per 100 lb.; garage outfits, hot-water supply outfits, Arcola boilers singly and repairs, 30 cts. per 100 lb.

Kansas City—Radiator boiler outfits, no added charge. Garage outfits, 35 cts. per 100 lb. Hot-water supply outfits, Arcola boilers singly and repairs, 45 cts. per 100 lb.

Arcola outfits or single boilers, not regularly carried in stock at branch warehouses, will be shipped from Buffalo, N. Y., subject to the above freight allowance only.

Radiators.—The discount on radiators and boilers fluctuates throughout the year. The lowest price is for the months of February, March and April. The price advances the first of May and holds through the month of June. The second advance is for July and August. The third advance is for September and October with a very slight lowering for December and January. The prices given show the list and discounts for the December, 1923 and January, 1924 period and for February 1 to April 30, 1924. The list prices are seldom changed. They are the same for both steam and hot-water

radiators, and whether of 1, 2, 3 or 4 columns. The list prices of radiators per square foot are:

	Per Foot		Per Foot
18 in.	$1.00	26 in.	$0.84
20 in.	0.96	32 in.	0.76
22 in.	0.90	38 in.	0.70
23 in.	0.88	43 in.	0.74

The discounts vary for different quality and are also slightly different for steam and hot water. They are as shown in the following tables:

American Direct Radiation

Pattern	Style	From Dec. 1, 1923 to Jan. 31, 1924, trade discount, per cent	From Feb. 1, to Apr. 30, 1924, trade discount, per cent
Peerless	1-Column steam	36.5	40.5
Peerless	1-Column water	34.6	38.7
Peerless	2-Column steam	39.4	43.2
Peerless	2-Column water	37.7	41.6
Peerless	3-Column steam	41.7	45.4
Peerless	3-Column water	39.9	43.7
Peerless	4-Column water	39.9	43.7
Peerless hospital	1-Column water	29.2	33.7
Peerless hospital	2-Column water	33.8	38.0
Peerless hospital	3-Column water	37.0	41.0
Peerless hospital	4-Column water	37.0	41.0
Corto	Steam	22.1	27.0
Corto	Water	20.6	25.6
Peerless window	Steam or water	39.9	43.7
Arco window	Steam or water	39.9	43.7

Note.—Corto Radiation can be furnished on special order with 6-in. legs, or without legs. No other special features can be supplied.

AMERICAN INDIRECT RADIATION

Pattern and description	Style	Square feet per second	List prices per square foot	From Dec. 1, 1923 to Jan. 31, 1924, trade discount, per cent	From Feb. 1, to April 30, 1924, trade discount, per cent
Perforated pin, standard size, F. & B.	S. or W.	10	$0.50	30.9	35.3
Perforated pin, standard size, nipple	S. or W.	10	0.50	30.3	34.7
Perforated pin, extra large, F. & B.	S. or W.	15	0.50	30.9	35.3
Perforated pin, extra large, nipple	S. or W.	15	0.50	30.3	34.7
Sanitary pin	S. or W.	20	0.50	30.3	34.7
Excelsior	Steam	12	0.50	30.9	35.3
Excelsior	Water	12	0.50	30.3	34.7
Cardinal	S. or W.	15	0.50	30.3	34.7
Sterling	Water	20	0.50	30.3	34.7

An additional charge of 1½ cts. per foot will be made for assembling indirect radiation.

Weight of Radiators.—For estimating purposes the following approximate weight of radiators per square foot of radiation may be used: Peerless Steam, 6 lb.; Water, 6½ lb.; Peerless Wall, 7 lb.; Corto, 5¾ lb.; all other patterns Direct Radiation, 6½ lb.; all patterns indirect radiation, 5 lb.

Freight Terms, Factory Shipments.—All prices quoted herein are f.o.b. Buffalo, N. Y., with the actual carload rate of freight only allowed on either carload or less than carload shipments, to any railroad point of destination where this rate does not exceed 30 cts. per 100 lb. Exceptions: No freight allowance will be made on radiator repairs nor on shipment of less than 100 lb.

Cost of Piping, Valves, Fittings, Etc.—All the items of an installation should be listed and the current unit prices applied. Where this is not possible, the following approximate prices per radiator for these items may be used.

For small and medium sized residences and other such buildings, with the present market price of pipe, the cost of these items is from $15 to $18. For first class apartment houses, office buildings, etc., the approximate price is from $18 to $23. For factory buildings with long runs of pipe, large radiators or coils, the price will range from $30 to $40.

Labor for Installing Hot-water and Steam Heating Systems.—The time required to install ordinary boilers for either hot water or steam, after the foundations are ready to receive them, is as follows:

No. 1 to No. 4 boiler, man and helper, 5 hr.
No. 4½ to No. 6 boiler, man and helper, 8 hr.
No. 6A to No. 8 boiler, man and helper, 12 hr.

The time required to erect hot-water mains in pairs on ceilings only, allowing fittings at an average of every 10 ft., is:

NUMBER OF FEET PER 8 HR.

1 in. 100	2 in. 60	3½ in. 25
1¼ in. 100	2½ in. 50	4 in. 20
1½ in. 90	3 in. 30	

The time required to erect branches across the ceiling and through the ground floor with valve and elbow at the proper height to receive the radiator is:

NUMBER OF BRANCHES PER 8 HR.

¾ in. 10	1¼ in. 6
1 in. 8	1½ in. 4

The time required to erect a pair of risers from 1 to 3 in. in size, allowing a fitting at an average of every 10 ft., is:

NUMBER OF FEET PER 8 HR.

1 in. 70	2 in. 40
1¼ in. 60	2½ in. 30
1½ in. 45	3 in. 20

The number of branches that can be run from these risers to the various radiators, at an average distance of 8 ft. from the riser with branches brought through the floor at the proper height to receive elbow and valve for the radiator, is:

NUMBER OF BRANCHES PER 8 HR.

¾ in. 6	1¼ in. 4
1 in. 6	1½ in. 4

The time allowed to set and connect each radiator with an average connection of 1 in. is:

1½ hr. for a man and a helper

The time allowed for setting and connecting one automatic expansion tank complete is:

8 hr. for a man and a helper

The above time allowed includes the installing of all necessary hangers on the basement ceiling, and all necessary straps and supports on risers. No cutting or repairing of passages of pipes is included.

Single-pipe Gravity Steam Job.—The time allowed to erect steam main on the ceiling with a fitting at an average of every 10 ft. is:

Number of Feet per 8 Hr.	
2 in. 80	4 in. 35
2½ in. 70	4½ in. 32
3 in. 50	5 in. 30
3½ in. 45	6 in. 30

The time to erect drip line with a fitting at an average of every 10 ft. is:

Number of Feet per 8 Hr.	
1½ in. 120	2½ in. 90
2 in. 100	3 in. 75

The time to erect single riser with a fitting at an average of every 10 ft. is:

Number of Feet per 8 Hr.	
1 in. 120	2½ in. 70
1¼ in. 115	3 in. 60
1½ in. 100	3½ in. 60
2 in. 85	4 in. 45

The number of branches that should be run from these risers to the various radiators at an average distance from the riser of 8 ft., with branches brought through the floor, at the proper height to receive an elbow and valve for the radiator, is:

Number of Branches per 8 Hr.	
1 in. 16	1½ in. 12
1¼ in. 14	2 in. 8

The time allowed to set and connect each radiator is:

Number of Radiators per 8 Hr.	
1 in. 30	1½ in. 20
1¼ in. 25	2 in. 12

This time is all based on the supposition that thimbles and sleeves are provided in the concrete work and that the cutting in the wood work is done by others.

Two-pipe Vacuum System Steam Jobs.—The time allowed to erect a pipe from the top of the boiler along the ceiling of basement, allowing a fitting at an average of every 10 ft., is:

	Number of Feet per 8 Hr.		
2	in.	80	
2½	in.	75	
3	in.	70	
3½	in.	55	
4	in.	50	
4½	in.	40	
5	in.	30	
6	in.	20	
7	in.	20	
8	in.	16	

The time to erect the corresponding return line with a fitting at an average of 10 ft. is:

	Number of Feet per 8 Hr.		
1¼	in.	110	
1½	in.	100	
2	in.	95	
2½	in.	85	
3	in.	80	
3½	in.	70	
4	in.	60	

The time to erect risers with a fitting at an average of every 10 ft. is:

	Number of Feet per 8 Hr.		
1	in.	120	
1¼	in.	115	
1½	in.	100	
2	in.	90	
2½	in.	80	
3	in.	65	
3½	in.	60	
4	in.	55	

The time to erect return risers with a fitting at an average of every 10 ft. is:

	Number of Feet per 8 Hr.		
1	in.	120	
1¼	in.	115	
1½	in.	100	
2	in.	90	
2½	in.	80	

The time required to erect branches from these risers to the radiators with connections brought through the floor and left at the

Amount of Radiation per Section

Radiators

Number section	1, Column inches					2, Columns inches						3, Columns inches						4, Columns inches						Number section
	38	32	26	23	20	45	38	32	26	23	20	45	38	32	26	22	18	45	38	32	26	22	18	
1	3	2.5	2	1.6	1.5	5	4	3.3	2.6	2.3	2	6	5	4.5	3.6	3.0	2.3	10	8	6.5	5	4	3	1
2	6	5.0	4	3.3	3.0	10	8	6.6	5.3	4.6	4	12	10	9.0	7.5	6.0	4.5	20	16	13.0	10	8	6	2
3	9	7.5	6	5.0	4.5	15	12	10.0	8.0	7.0	6	18	15	13.5	14.2	9.0	6.7	30	24	19.5	15	12	9	3
4	12	10.0	8	6.6	6.0	20	16	13.3	10.6	9.3	8	24	20	18.0	15.0	12.0	9.0	40	32	26.0	20	16	12	4
5	15	12.5	10	8.3	7.5	25	20	16.6	13.3	11.6	10	30	25	22.5	18.7	15.0	11.2	50	40	32.5	25	20	15	5
6	18	15.0	12	10.0	9.0	30	24	20.0	16.0	14.0	12	36	30	27.0	22.7	18.0	13.5	60	48	39.0	30	24	18	6
7	21	17.5	14	11.6	10.5	35	28	23.3	18.6	16.3	14	42	35	31.5	26.2	21.0	15.7	70	56	45.5	35	28	21	7
8	24	20.0	16	13.3	12.0	40	32	26.6	21.3	18.6	16	48	40	36.0	30.0	24.0	18.0	80	64	52.0	40	32	24	8
9	27	22.5	18	15.0	13.5	45	36	30.0	24.0	21.0	18	54	45	40.5	33.7	27.0	20.2	90	72	58.5	45	36	27	9
10	30	25.0	20	16.6	15.0	50	40	33.3	26.6	23.3	20	60	50	45.0	37.5	30.0	22.5	100	80	65.0	50	40	30	10
20	60	50.0	40	33.3	30.0	100	80	66.6	53.3	46.6	40	120	100	90.0	75.0	60.0	45.0	200	160	130.0	100	80	60	20
30	90	75.0	60	50.0	45.0	150	120	100.0	80.0	70.0	60	180	150	135.0	112.5	90.0	67.5	300	240	195.0	150	120	90	30

proper height to receive elbows and valves for the radiators with an average distance of 5 ft. from the risers is:

1½ hr. for a man and a helper.

The time allowed to set and connect each radiator is:

1½ hr. for a man and a helper.

The time allowed to connect in the boiler room the standard outfit comprising:

1 boiler feed pump and receiver.
1 vacuum pump with all necessary steam and exhaust connections, suction and discharge connections, at an average distance from the boiler of 20 ft.; the average pipe connections being as follows:
Steam, 1 in., exhaust 1¼ in., cold-water connections to receiver ¾ in., discharge from pump to boiler, 1½ in., suction on vacuum pump, 4 in.

40 hr. for a man and a helper.

AMOUNT OF RADIATION PER LINEAR FOOT

Coils

Diameter, inches	Pipe coils, feet															Diameter, inches
	1	2	3	4	5	6	7	8	9	10	20	30	40	50	100	
¾	0.27	0.5	0.8	1.1	1.4	1.6	1.9	2.2	2.5	2.7	5.5	8.3	11.0	13.8	27.0	¾
1	0.34	0.7	1.0	1.4	1.7	2.1	2.4	2.8	3.1	3.5	6.9	10.4	13.8	17.3	34.6	1
1¼	0.43	0.9	1.3	1.7	2.2	2.6	3.0	3.5	3.9	4.3	8.7	13.0	17.4	21.7	43.4	1¼
1½	0.49	1.1	1.5	2.0	2.4	2.9	3.4	3.9	4.4	4.9	9.9	14.8	19.8	24.7	49.4	1½
2	0.62	1.2	1.9	2.5	3.1	3.7	4.4	5.0	5.6	6.2	12.5	18.7	24.9	31.1	62.2	2
2½	0.75	1.5	2.3	3.0	3.8	4.5	5.3	6.0	6.8	7.5	15.0	22.5	30.1	37.6	75.2	2½
3	0.91	1.8	2.7	3.6	4.6	5.5	6.4	7.3	8.2	9.1	18.3	27.5	36.6	45.8	91.6	3
4	1.17	2.4	3.5	4.7	5 8	7.0	8.2	9.4	10.6	11.8	23.5	35.3	47 0	58.7	117.4	4
5	1.45	2.9	4.4	5.8	7.3	8.7	10.2	11.6	13.1	14.6	29.1	43.6	58.2	72.7	145.4	5
6	1.73	3.5	5.2	7.0	7.7	10.5	12.1	13.9	15.7	17.4	34.8	52.1	69.5	87.0	174.0	6
7	1.99	4.0	6.0	8 0	10.0	12.0	14.0	16.0	18.0	20.0	40.0	60.0	80.0	100.0	200.0	7

LABOR REQUIRED FOR COVERING AND PAINTING PIPES AND FITTINGS

Exact cost data that will apply to all pipe covering work cannot be given on account of certain variables such as the amount of scaffold-

ing required, the accessibility of pipes and the clearance available for covering. Therefore the following tables should not be used for other than average work without making some allowance for such conditions. For the usual job, however, the tables should be helpful to the estimator as they are based on the experience of a number of large covering contractors.

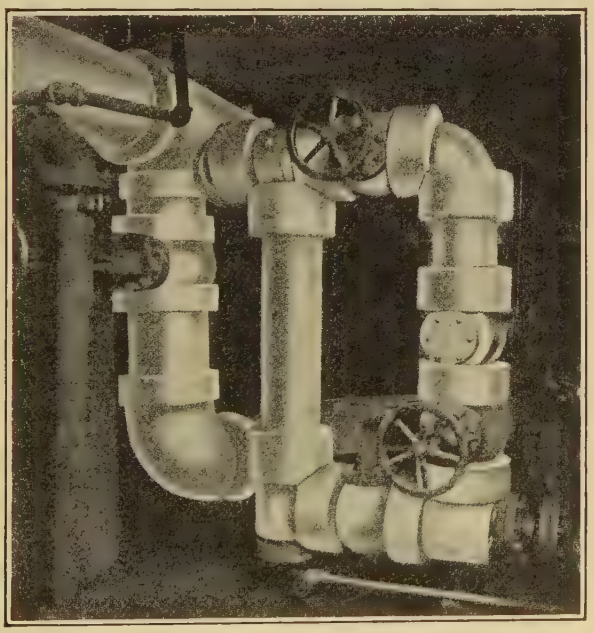


Fig. 6.—Magnesia covering for valves, flanges and fittings.

Time Required in Hours per Linear Foot of Pipe Covered or Painted

Size of pipe, inches	Covered, Man and helper							Painted, Two coats lead and oil		
	No extra canvas				Recanvased					
	Asbestocel 2- to 4-ply	85 per cent magnesia		Hair felt all thicknesses	Asbestocel 2- to 4-ply	85 per cent magnesia		85 per cent magnesia		Bare pipe
		Standard thickness	Double standard thickness			Standard thickness	Double standard thickness	Standard thickness	Double standard thickness	
¾	0.028	0.034	0.040	0.067	0.080	0.087	0.104	0.021	0.034	0.010
1	0.028	0.034	0.043	0.067	0.081	0.087	0.105	0.023	0.036	0.012
1¼	0.028	0.035	0.043	0.068	0.081	0.088	0.105	0.025	0.038	0.015
1½	0.029	0.035	0.044	0.068	0.083	0.089	0.107	0.027	0.040	0.016
2	0.030	0.036	0.045	0.069	0.085	0.091	0.109	0.032	0.048	0.020
2½	0.030	0.036	0.046	0.070	0.086	0.092	0.112	0.036	0.051	0.022
3	0.031	0.037	0.046	0.071	0.088	0.094	0.113	0.041	0.056	0.026
3½	0.032	0.038	0.048	0.072	0.090	0.096	0.116	0.045	0.060	0.029
4	0.033	0.039	0.048	0.073	0.091	0.098	0.118	0.050	0.066	0.033
4½	0.034	0.040	0.049	0.074	0.095	0.101	0.120	0.053	0.070	0.037
5	0.035	0.041	0.051	0.075	0.097	0.103	0.124	0.057	0.073	0.041
6	0.037	0.043	0.053	0.077	0.101	0.107	0.129	0.064	0.081	0.048
7	0.040	0.046	0.057	0.080	0.106	0.112	0.136	0.073	0.092	0.056
8	0.043	0.049	0.062	0.082	0.113	0.119	0.145	0.080	0.096	0.063
9	0.046	0.053	0.069	0.085	0.119	0.126	0.156	0.084	0.100	0.071
10	0.051	0.057	0.076	0.089	0.128	0.134	0.168	0.089	0.105	0.074
11	0.056	0.062	0.087	0.091	0.137	0.143	0.183	0.094	0.111	0.078
12	0.062	0.068	0.100	0.094	0.147	0.153	0.196	0.099	0.118	0.083
14	0.074	0.114	0.178	0.101	0.164	0.204	0.286	0.107	0.127	0.089
15	0.077	0.121	0.186	0.105	0.169	0.213	0.297	0.113	0.133	0.095
16	0.080	0.129	0.200	0.110	0.175	0.224	0.316	0.119	0.138	0.100
18	0.086	0.145	0.228	0.119	0.186	0.245	0.353	0.132	0.151	0.113
20	0.091	0.157	0.242	0.129	0.198	0.264	0.375	0.145	0.163	0.125
22	0.095	0.174	0.266	0.138	0.213	0.292	0.417	0.157	0.175	0.138
24	0.100	0.190	0.296	0.151	0.233	0.323	0.470	0.170	0.189	0.151
30	0.121	0.235	0.400	0.200	0.275	0.369	0.610	0.208	0.226	0.190

TIME REQUIRED IN HOURS PER SQUARE FOOT OF FLAT SURFACE COVERED

Man and helper

Kind of covering	Without canvas	With canvas
1 in. cement	0.062	0.076
1½ in. cement	0.071	0.084
1 in. blocks and ½ in. cement	0.053	0.067
1½ in. blocks and ½ in. cement	0.053	0.067

The number of labor hours as given in the preceding table for covering and canvasing is the time required for a man and a helper to do the work, whereas for painting the time for one man only is given. For example, at the hourly rates of $1.25 for a pipe coverer, $1 for his helper and $1.25 for a painter, the cost per linear foot for covering a 10-in. pipe with 85 per cent magnesia, for recanvasing and painting with two coats of lead and oil, would be 0.134 times (1.25 + 1.00) or 30.15 cts. for covering and 0.089 times 1.25 or 11.125 cts. for painting, or a total of 41.275 cts. This does not include the cost of paint. To obtain the cost for labor and paint 11 cts. must be added. This is on the assumption that the cost of lead and oil paint is about the same as the cost of labor.

Although the time required to cover piping is given for the ordinary kinds of covering, *i.e.*, with the commercial light-weight jacket furnished with the insulation or recanvased with 8-oz. duck, the table can be used equally well for any other coverings having roughly the same surface area. For thicknesses other than those given, an amount can be calculated on a basis of change in area.

TIME REQUIRED IN HOURS PER EACH FITTING COVERED OR PAINTED

Size of pipe	Covered—1-in. cement Man and helper				Painting (only) (Two coats lead and oil)		
	No extra canvas		Recanvased				
	Fittings exclusive of flanges on fittings	Pairs of flanges	Fittings exclusive of flanges on fittings	Pairs of flanges	1-in. cement fittings	Pairs of flanges with 1-in. covering	Bare fittings
¾	0.072	.....	0.084	.....	0.006	.....	0.004
1	0.073	.....	0.086	.....	0.007	.....	0.005
1¼	0.074	.....	0.088	.....	0.010	.....	0.008
1½	0.077	.....	0.094	.....	0.013	.....	0.010
2	0.082	.....	0.102	.....	0.015	.....	0.011
2½	0.087	.....	0.114	.....	0.018	.....	0.014
3	0.094	.....	0.127	.....	0.023	.....	0.017
3½	0.113	0.167	0.139	0.187	0.032	0.024	0.024
4	0.147	0.187	0.180	0.210	0.042	0.027	0.032
4½	0.062	0.196	0.199	0.220	0.045	0.029	0.034
5	0.179	0.209	0.220	0.235	0.049	0.031	0.037
6	0.244	0.235	0.300	0.264	0.065	0.034	0.049
7	0.293	0.270	0.360	0.303	0.078	0.039	0.059
8	0.391	0.299	0.480	0.334	0.104	0.044	0.078
9	0.440	0.333	0.540	0.375	0.113	0 049	0.085
10	0.537	0.368	0.660	0.414	0.138	0.054	0.104
11	0.659	0.406	0.810	0.456	0.169	0.060	0.127
12	0.708	0.443	0.870	0.498	0.174	0.065	0.131
14	0.928	0.512	1.140	0.576	0.228	0.075	0.171
15	0.977	0.547	1.200	0.615	0.240	0.080	0.180
16	1.124	0.585	1.380	0.659	0.276	0.086	0.207
18	1.368	0.656	1.680	0.738	0.336	0.096	0.252
20	1.563	0.744	1.920	0.837	0.384	0.109	0.288
22	1.954	0.830	2.400	0.934	0.480	0.121	0.360
24	2.247	0.924	2.760	1.040	0.552	0.135	0.414
30	3.175	1.184	3.900	1.332	0.780	0.173	0.585

In table "Time Required in Hours per each Fitting Covered or Painted," the columns headed "Pairs of flanges" give the labor hours required to cover a pair of flanges (2 flanges) and are for use when the flanges of fittings are to be covered, as well as the body of the fittings. Likewise, the columns headed "Painting" with subheadings for both painting of covering and of bare pipes should be used jointly when the pipe and fittings are painted as well as covered.

Columns for "Bare pipe" and "Bare fittings" can be used for painting uncovered pipe and fittings.

As will be noted from the preceding tables, the cost for applying 85 per cent magnesia coverings on pipes of over 12-in. size is considerably more than for smaller pipes. This is due to the practice of covering the larger pipes with block forms 6 by 36 in., whereas for the smaller pipes the covering is made sectional in 3-ft. lengths and in two halves for quick application and then covered with light canvas secured by sheet metal bands.

There are a number of rough methods often used for estimating the cost of covering pipes. Expressed in terms of labor hours per square foot of surface, they are 0.027 for pipes of over 12-in. size when covered with standard thick 85 per cent magnesia, 0.2 for each pair of flanges covered with 1 in. of magnesia and recanvased, and 0.12 for covered and recanvased fittings of over 3-in. size. For fittings ½ to 3 in. in size the labor hours are 0.114 for each fitting. The labor hours required to paint piping as well as flat surfaces, such as on boilers, tanks, heaters and the like, can be taken at 0.028 per square foot. For canvasing flat surfaces and work on pipes of over 12-in. size, 0.013 hr. are used per square foot of surface.

SQUARE FOOT AREA OF STANDARD SCREW FITTINGS

Pipe size, inches	Thickness of covering						Pipe size, inches
	½ in.	1 in.	1½ in.	2 in.	2½ in.	3 in.	
¾	0.14	0.20	0.25	0.33	0.50	0.50	¾
1	0.20	0.25	0.33	0.50	0.50	0.50	1
1¼	0.25	0.37	0.50	0.50	0.66	0.66	1¼
1½	0.33	0.50	0.50	0.62	0.66	0.75	1½
2	0.50	0.50	0.66	0.75	0.83	1.00	2
2½	0.66	0.66	1.00	1.00	1.16	1.33	2½
3	0.83	1.00	1.00	1.25	1.50	1.66	3
3½	1.00	1.16	1.33	1.50	1.66	1.75	3½
4	1.20	1.50	1.50	1.75	2.00	2.16	4
4½	1.50	1.66	1.83	2.00	2.25	2.50	4½
5	1.66	1.83	2.00	2.25	2.50	2.66	5
6	2.16	2.50	2.66	2.75	3.00	3.33	6
7	2.83	3.00	3.33	4.00	4.16	4.33	7
8	3.50	4.00	4.00	4.50	4.75	5.75	8
9	4.25	4.50	5.00	5.25	5.50	6.00	9
10	5.16	5.50	5.66	6.00	6.50	7.00	10
11	6.00	6.75	6.66	7.00	7.50	8.00	11
12	6.83	7.25	7.66	8.00	8.50	9.00	12
14	9.00	9.50	10.00	10.50	11.00	.....	14
15	....	10.00	10.50	11.00	11.66	12.00	15
16	....	11.50	11.50	12.00	12.50	13.00	16
18	....	14.00	14.00	14.66	15.33	16.33	18
20	....	16.00	17.00	17.33	18.00	18.66	20
22	....	20.00	20.50	21.00	22.00	22.75	22
24	....	23.00	24.00	24.50	25.66	26.00	24
30	....	32.50	33.50	34.50	35.50	36.00	30

SQUARE FOOT AREA PER LINEAR FOOT OF PIPE AND PIPE COVERING

Pipe size	Thickness of covering							Bare pipe
	½ in.	¾ in.	Standard	1 in.	1½ in.	2 in.	3 in.	Double standard	
¾	0.54	0.67	0.73	0.80	1.06	1.32	1.85	1.19	0.27
1	0.61	0.74	0.80	0.87	1.13	1.39	1.92	1.26	0.34
1¼	0.70	0.83	0.89	0.96	1.22	1.48	2.01	1.35	0.43
1½	0.76	0.89	0.96	1.02	1.28	1.54	2.07	1.41	0.50
2	0.88	1.01	1.16	1.15	1.41	1.67	2.19	1.70	0.62
2½	1.01	1.15	1.29	1.28	1.54	1.80	2.32	1.83	0.75
3	1.18	1.31	1.46	1.44	1.70	1.98	2.49	2.00	0.92
3½	1.31	1.44	1.59	1.57	1.83	2.09	2.62	2.13	1.05
4	1.44	1.57	1.77	1.70	1.96	2.23	2.75	2.36	1.18
4½	1.57	1.70	1.90	1.83	2.09	2.36	2.88	2.49	1.31
5	1.72	1.85	2.05	1.98	2.24	2.50	3.03	2.63	1.46
6	2.00	2.13	2.32	2.26	2.52	2.78	3.31	2.91	1.73
7	2.26	2.39	2.65	2.52	2.78	3.04	3.57	3.31	2.00
8	2.52	2.65	2.91	2.78	3.04	3.31	3.83	3.57	2.26
9	2.78	2.91	3.17	3.04	3.31	3.57	4.09	3.83	2.52
10	3.08	3.21	3.47	3.34	3.60	3.86	4.39	4.12	2.81
11	3.34	3.47	3.73	3.60	3.86	4.12	4.65	4.39	3.08
12	3.60	3.73	4.12	3.86	4.12	4.39	4.91	4.91	3.34
14	3.93	4.06	4.45	4.19	4.45	4.71	5.24	5.24	3.67
15	4.19	4.32	4.71	4.45	4.71	4.97	5.50	5.50	3.93
16	4.45	4.58	4.97	4.71	4.97	5.24	5.76	5.76	4.19
18	4.97	5.11	5.50	5.24	5.50	5.76	6.28	6.28	4.71
20	5.50	5.63	6.02	5.76	6.02	6.28	6.81	6.81	5.24
22	6.02	6.15	6.55	6.28	6.55	6.81	7.33	7.33	5.76
24	6.55	6.68	7.07	6.81	7.07	7.33	7.85	7.85	6.28
30	8.12	8.25	8.64	8.38	8.64	8.90	9.42	9.42	7.85

Areas of Covering on Pipes and Pounds of Cement Required to Cover Fittings.—In determining the square feet of surface of covered pipes, the surface of the covering is taken instead of the area of the pipe or the fitting covered. For this reason two preceding Tables and have been compiled for the help of the estimator who will also find these tables of use when figuring the amount of canvas. Twenty per cent excess must be allowed over the figures given to take care of lap and waste.

It is a laborious process to compute the amount of cement required to cover fittings, so the following table is given which was prepared by the Franklin Manufacturing Company:

TABLE SHOWING THE POUNDS OF MAGNESIA CEMENT NECESSARY TO COVER FITTINGS

Pipe size, inches	Regular ells			Long radius, ells and tees			Standard flanged joint		Extra heavy flange		Globe vave		
	1 in.	2 in.	3 in.	1 in.	2 in.	3 in.	1 in.	2 in.	2 in.	3 in.	1 in.	2 in.	3 in.
1	0.4	1.2	2.5	0.8	2.0	4.0	2.0	9.7	9.7	20.0	1.5	3.0	6.0
1¼	0.5	1.4	2.8	0.9	2.2	4.5	2.1	10.1	10.1	21.0	1.7	3.5	6.5
1½	0.6	1.7	3.3	1.0	2.7	5.0	2.2	10.6	10.5	22.0	2.0	4.0	7.0
2	1.0	2.2	4.0	1.2	3.2	6.0	2.7	11.5	11.5	23.3	2.8	5.0	8.5
2½	1.2	2.8	5.0	1.7	4.0	7.4	3.2	12.5	12.7	25.0	3.2	6.0	9.7
3	1.4	3.2	6.0	2.0	5.0	8.7	3.6	13.5	14.3	27.0	4.0	7.2	11.3
3½	1.7	4.0	7.0	2.5	5.8	10.2	4.0	14.3	16.0	28.0	4.8	8.3	13.0
4	2.0	4.8	8.2	3.0	7.0	12.0	4.3	15.2	17.5	30.0	5.4	9.4	14.5
4½	2.4	5.6	9.6	3.4	8.0	13.4	4.7	16.0	19.0	33.0	6.2	10.6	16.5
5	2.8	6.3	11.0	4.0	9.0	15.2	5.0	17.0	20.6	35.0	7.0	12.0	19.0
6	3.6	8.0	13.3	4.3	12.0	19.5	6.0	19.0	24.0	40.0	8.2	15.0	23.5
7	4.3	9.5	15.8	6.7	14.6	24.5	7.0	21.0	27.0	45.0	10.0	17.8	29.0
8	5.0	11.0	18.3	8.1	17.0	29.3	7.8	22.7	30.2	50.0	11.5	20.8	34.5
9	6.3	14.0	22.2	9.7	21.5	35.0	8.6	24.6	33.3	55.0	13.0	25.2	41.0
10	7.6	16.0	26.0	11.6	25.5	41.0	9.3	21.5	36.6	60.0	14.5	30.0	48.0
12	10.0	21.0	33.8	16.0	34.0	55.0	11.0	30.0	43.0	70.0	18.5	39.0	62.0

NOTE.—For standard cross add 25 per cent to the amount required for a long radius elbow.

For No. 102 asbestos cement multiply the above quantity by 2, and for No. 3 asbestos cement multiply by 2½.

The amount given does not include flanges. The valves used as a basis of computation are standard globe valves and are assumed to be covered to the flange by which the valve is dismounted in order to get at the valve seat.

Efficiencies of Pipe Coverings.—The efficiency of pipe coverings varies according to the size of the pipe covered, the kind and thickness of covering and the difference in temperature between the inside of the pipe and the air surrounding the pipe. Painting the covering decreases the loss of heat to a slight extent and seals the surface against circulation of air. For the same reason, two layers of covering are sometimes better than one, as the second layer closes the openings between joints, but this practice is unnecessary on a job properly covered.

When it comes to the question of the proper thickness of pipe covering, it seldom pays to use a thickness under 1 in. Many

do so, however, and effect a slight saving thereby in cost of material, but considering the greater amount of heat lost by thinner coverings and the fact that the labor required to install either thickness is practically the same, there is nothing to be gained by this practice. However, the cheaper or thinner coverings may sometimes be used to advantage where fuel is cheap and the piping is in use but a small part of the time, or where piping in pipe tunnels need only be covered enough to keep the tunnels sufficiently cool for men to work in them.

CHAPTER XXV

ELECTRIC WIRING OF BUILDINGS

Preparing an Estimate.—The cost of wiring a building varies as much as the cost of building construction. The cost of wiring is usually only a small percentage of the cost of the building, approximately 1 to 1½ per cent. It should not, however, be treated lightly.

In estimating the cost of installation, there are three items which are most frequently overlooked, *viz.*, incidentals, overhead and supervision.

Incidentals are such small items as are necessary to complete the installation and yet are not usually specified. For a conduit job these would be: couplings, lock nuts, bendhicks, chase nipples, toggle bolts, supports, pipe straps, etc. For wiring these incidentals are: cable lugs, solder, soldering compound, friction tape, rubber tape, gasoline, coach candles, grease, loss and waste. On a BX Cable job the incidentals are bushings, straps, screws, covers, etc.

The cost of tools is also often forgotten, including such items as drills, hack saw blades, chisels, bars, saws, hammers, etc.

The following table shows the ratio of incidental materials as described above to the cost of the main items on a series of conduit jobs totaling $23,700 for the material, and $29,500 for the labor. The work was done in 1913, 1914 and 1915.

Main Items	Ratio of Incidental Materials to Main Items, per cent
Wire	4.85
Conduit	38.5
Lamp outlets	10.2
Panels and cabinets	6.0
Junction boxes	16.5
Insulators	12.6
Switchboards	2.9
Weighted average of all based on cost	11.8
Freight and cartage	2 per cent of the cost of the wire
Loss and waste	5 per cent of the cost of the wire
Ratio of labor to material	124.6

For example, knowing the size and length of wire required, add 4.85 per cent for incidentals, likewise the other items.

Every man is entitled to a fair price for his work. It should yield him a good living and enough in addition to lay aside for the future. It is better to lose a contract and to be idle than to take one at a loss. Those contractors who have been in business for years usually estimate correctly. Any rough method is only approximate and likely to lead to trouble.

Generally speaking, no two jobs are alike but they may be very similar. First, there are two distinct classes of wiring: Power and Lighting. These again can be divided into Open Work or Knob and Tube, Conduit and BX Cable. Since power wiring jobs vary greatly it is impractical to give any set rules for installation.

Lighting installations are divided into the following main classifications: dwellings, lofts, shops, office buildings, public halls, churches, passenger stations, freight stations, apartment houses, etc. These can be divided again according to the class of building construction as: all timber, tile with fireproof walls, floors and ceilings, etc. From this list it can be noted at a glance that a unit price which is reasonable for one class may be quite misleading in others.

The contractor who is giving an estimate on the cost of a wiring installation will usually express it in terms of outlets based on the intensity of illumination expressed in watts. The number of outlets is governed by the kind of lighting, such as direct, indirect or semi-indirect. Since the Underwriters' rules limit the total wattage per outlet, it is obvious that direct lighting is cheapest while indirect lighting is the most expensive.

Kinds of Lighting.—In direct lighting, the lamps throw the light directly on the object. In indirect lighting, the lamps are concealed and the light is thrown on a reflecting surface which in turn illuminates the objects. With this class of lighting there are always special architectural features which should be carefully noted. For example, it should be specified which contractor supplies and installs them.

Semi-indirect lighting is a combination of direct and indirect lighting. For public halls it is the one most generally used. It usually consists of a large opalescent bowl or group of bowls which pass some of the light directly to the object and reflect some of the light to the ceiling or to a reflecting plate just above or in back of the lamps.

Labor to Install Electric Wiring.—The table below gives the cost of the labor to install conduit work including ells and bends, in

various buildings with the labor rate based on $1 per hour. This rate includes a man and a helper and one-quarter of the foreman's time. If the rate is higher or lower the difference in cost can be easily computed.

	Shops, Factories, Warehouses, Freight Houses, Pier Sheds, Etc.	Fireproof Buildings—All Pipe Concealed
½-in. conduit	$0.06 per linear foot	$0.10 per linear foot
¾-in. conduit	0.07 per linear foot	0.11 per linear foot
1 -in. conduit	0.10 per linear foot	0.14 per linear foot
1¼-in. conduit	0.14 per linear foot	0.16 per linear foot
1½-in. conduit	0.18 per linear foot	0.19 per linear foot
2 -in. conduit	0.24 per linear foot	0.25 per linear foot
2½-in. conduit	0.31 per linear foot	0.32 per linear foot
3 -in. conduit	0.38 per linear foot	0.39 per linear foot

The above prices do not include roughing in ceiling outlets, switch boxes, junction boxes, cabinets, etc., or the cutting of walls.

Wiring Private Dwellings.—Private dwellings are wired in three ways, *viz.:* Conduit, BX Cable, and Knob and Tube. BX Cable, however, is used in most residence wiring. Usually the rough estimate is made on the basis of the number of outlets, counting all switches and base plugs as separate outlets. For example, a ceiling light controlled by a switch on the side wall counts as two outlets. This method of estimating is used by the smaller contractors. At least 10 per cent should be added to the estimated cost for overhead.

The following table shows the actual cost of a number of jobs on the basis of the number of outlets, and counting switches as outlets. All this work was of rigid conduit and was run exposed on walls except the last item where the conduit was concealed:

11 Outlets	$ 7.60 per outlet	2 circuits
12 Outlets	6.00 per outlet	2 circuits
15 Outlets	5.00 per outlet	3 circuits
25 Outlets	3.00 per outlet	4 circuits
156 Outlets	2.50 per outlet	8 circuits
586 Outlets	10.40 per outlet	52 circuits

The above are the actual costs of the work plus supervision on the basis of $8 per 8-hr. day for a journeyman and a helper.

The price of installation of BX Cable in ordinary wood constructed dwellings was $6.50 per outlet in 1921. The installation in frame house using knob and tube work cost from $3.50 to $5 per outlet. In 1914, the Edison Electric Illuminating Company of New York City established a series of prices for wiring old houses with BX Cable. The price per outlet varied from $5 to $7 including fixture switches, cabinet, cutouts and service connection ready for the fixtures and service.

An eleven-room house in the suburbs of New York City was wired in 1922. The house had 53 outlets as follows: 19 single-way switch outlets and base plugs; 2 3-way switch outlets; 4 cellar outlets; 8 ceiling outlets and 20 side-wall outlets. The contract price was $365, which was for labor and material and included all base and switch receptacles and covers.

Wiring Shop and Factory Buildings.—The following list represents installations made by a New York City contractor:

Year	Number outlets	Cost per outlet	Class of work
1908	366	$19.00	Fireproof, concealed
1908	101	25.24	Open on steel
1909	128	4.80	
1911	29	8.62[1]	On face of tile walls
1910	512	3.60	
1911	28	13.86	Fireproof, concealed
1911	72	8.47[1]	
1910	42	26.19	Open high ceilings, long runs
1914	1,860	10.41	Fireproof, concealed

[1] Work was done at a loss.

Conduit Sizes for Wire
Rubber Covered Double Braid
New Code

Size of wire, American wire gage	Ampere capacity	Size conduits				Lamp capacity 3-wire system, 220, 110, 220						
		1 wire, in.	2 wires, in.	3 wires, in.	4 wires, in.	Feeder wattage	Lamp wattage					
							25	40	50	60	75	100
14	15	½	½	½	¾	3,300	132	82	66	55	44	33
12	20	½	¾	¾	¾	4,400	176	110	88	73	58	44
10	25	½	¾	¾	1	5,500	220	137	110	91	73	55
8	35	½	1	1	1	7,700	308	192	154	128	102	77
6	50	½	1	1	1¼	11,000	440	275	220	183	146	110
5	55	¾	1¼	1¼	1¼	12,100	484	302	242	201	161	121
4	70	¾	1¼	1¼	1½	15,400	616	385	308	256	205	154
3	80	¾	1¼	1¼	1½	17,600	704	440	352	293	234	176
2	90	¾	1¼	1¼	1½	19,800	792	495	396	330	264	198
1	100	¾	1½	1½	2	22,000	880	550	440	366	293	220
0	125	1	1½	1½	2	27,500	1,100	687	550	458	366	275
00	150	1	2	2	2½	33,000	1,320	825	660	550	440	330
000	175	1	2	2	2½	38,500	1,540	962	770	641	518	385
0000	225	1¼	2	2	2½	49,500	1,980	1,237	990	825	660	495
250MCM	240	1¼	2½	2½	3	52,800	2,112	1,320	1,056	880	704	528
300MCM	275	1¼	2½	2½	3	60,500	2,420	1,512	1,210	1,008	806	605
400MCM	325	1¼	3	3	3½	71,500	2,860	1,787	1,430	1,191	953	715
500MCM	400	1½	3	3	3½	88,000	3,520	2,200	1,760	1,466	1,173	880
600MCM	450	1½	3	3½	...	99,000	3,960	2,475	1,980	1,650	1,320	990
700MCM	500	2	3½	3½	...	110,000	4,400	2,750	2,200	1,833	1,466	1,100
800MCM	550	2	3½	4	...	121,000	4,840	3,025	2,420	2,016	1,613	1,210
1,000MCM	650	2	4	4	...	143,000	5,720	3,575	2,860	2,383	1,906	1,430
1,250MCM	750	2½	4½	4½	...	165,000	6,600	4,125	3,300	2,750	2,200	1,650
1,500MCM	850	2½	4½	5	...	187,000	7,480	4,675	3,740	3,116	2,490	1,870
2,000MCM	1,050	3	5	6	...	231,000	9,240	5,775	4,620	3,850	3,080	2,310
No. 14 duplex....	15	½	¾	1	1							
No. 12 duplex....	20	½	¾	1	1¼							
No. 10 duplex....	25	¾	1	1¼	1¼							

Wire for A.C. 3-phase Motors 220 and 440 Volts and 220-volt D.C. Motors

Horse-power motors	D.C. motors			220-volt (3-phase A.C. motors)			440-volt		
	Current full load	Size wire	Con-duit 2 wires	Full load current	Size wire	Size con-duit	Full load current	Size wire	Size con-duit
1	4	No. 14	½	3	No. 14	½	2	No. 14	½
2	8	14	½	5	14	½	3	14	½
3	12	14	½	8	14	½	4	14	½
4	15	12	¾	10	14	½	5	14	½
5	19	10	¾	13	12	¾	6	14	½
7½	28	8	1	19	8	1	10	14	½
10	38	6	1	26	6	1	13	12	¾
12.5	47	4	1¼	32	6	1	16	10	¾
15	56	4	1¼	38	4	1¼	19	8	1
17.5	65	3	1¼	45	4	1¼	22	8	1
20	75	1	1½	51	3	1¼	26	6	1
25	94	0	1½	64	1	1½	32	6	1
30	113	00	2	77	0	2	38	4	1¼
35	131	000	2	90	00	2	45	4	1¼
40	150	0000	2	102	00	2	51	3	1¼
45	169	0000	2	115	000	2	58	2	1½
50	188	250MCM	2½	128	0000	2½	64	1	1½
55	206	300MCM	2½	141	0000	2½	70	0	2
60	225	300MCM	2½	154	250MCM	2½	77	0	2
65	244	350MCM	2-1¼	166	300MCM	2½	83	0	2
70	263	400MCM	2-1¼	179	300MCM	2½	90	00	2
75	281	500MCM	2-1½	192	350MCM	2½	96	00	2
80	300	500MCM	2-1½	205	400MCM	3	102	00	2
85	319	500MCM	2-1½	218	400MCM	3	109	000	2½
90	338	600MCM	2-1½	230	500MCM	3	115	000	2½
95	356	600MCM	2-1½	243	500MCM	3	122	0000	2½
100	375	700MCM	2-2	256	500MCM	3	128	0000	2½
125	463	900MCM	2-2	320	700MCM	3½	160	250MCM	2½
150	563	1,100MCM	2-2	384	900MCM	4	192	350MCM	2½
200	750	1,700MCM	2-3	512	2-500MCM	2-3	256	500MCM	3
250	938	2-900MCM	4-2	640	2-700MCM	2-3½	320	700MCM	3½
300	1,125	2-1,100MCM	4-2	768	3-500MCM	3-3	384	900MCM	4

MCM = 1,000 circular mills.

The following tables show the intensity of light required for various classes of buildings and work rooms:

PRESENT STANDARDS OF ILLUMINATION—FOOT CANDLES

	INTENSITY OF LIGHT IN FOOT CANDLES PER SQUARE FOOT
Industrial:	
Aisles, stairways, passageways and corridors	1–2
Steel and iron mills, bar, sheet and wire products:	
Soaking pits and reheating furnaces	1–2
Auditorium, church	2–4
Boilers, engine rooms and power houses:	
Boilers, coal and ash-handling, storage battery rooms	2–4
Chemical works:	
Hand furnaces, boiling tanks, stationary driers, stationary or gravity crystallizing	2–4
Clay products and cements:	
Grinding, filter presses, kiln rooms	2–4
Leather manufacturing:	
Vats	2–4
Locker rooms	2–4
Steel and iron mills, bar, sheet and wire products:	
Charging and casting floors	2–4
Store and stock rooms:	
Rough	2–4
Armory, public hall	3–6
Industrial:	
Assembling:	
Rough	3–6
Boilers, engine rooms and power houses:	
Auxiliary equipment, oil switches and transformers	3–6
Chemical works:	
Mechanical furnaces, generators and stills, mechanical driers, evaporators, filtration, mechanical crystallizing, bleaching	3–6
Clay products and cements:	
Molding, pressing, cleaning and trimming	3–6
Elevator, freight and passenger	3–6
Foundries:	
Charging floor, tumbling, cleaning, pouring and shaking out	3–6
Glass works:	
Mix and furnace rooms, casting and Lehr	3–6

PRESENT STANDARDS OF ILLUMINATION—FOOT CANDLES.—(*Continued*)

	INTENSITY OF LIGHT IN FOOT CANDLES PER SQUARE FOOT
Leather manufacturing:	
Cleaning, tanning and stretching	3–6
Meat packing:	
Slaughtering	3–6
Milling and grain foods:	
Cleaning, grinding or rolling	3–6
Packing:	
Rough	3–6
Paint shops:	
Dipping, spraying, firing	3–6
Paper manufacturing:	
Beaters, machine, grinding	3–6
Plating	3–6
Receiving and shipping	3–6
Soap manufacturing:	
Kettle houses, cutting, soap chip and powder	3–6
Steel and iron mills, bar, sheet and wire products:	
Muck and heavy rolling, shearing, rough by gage, pickling and cleaning	3–6
Textile mills:	
(Cotton)	
Opening and lapping, carding, drawing frame, dyeing	3–6
(Woolen)	
Carding, picking, washing and combing	3–6
Toilet and wash rooms	3–6
Wood working:	
Rough sawing and bench work	3–6
Store:	
Drug, grocery, meat, bakery, book, florist, furniture, lunch room, confectionery, etc	4–8
Boilers, engine rooms and power houses:	
Switch boards, engines, generators, blowers, compressors	4–8
Chemical works:	
Tanks for cooking, extractors, percolators, nitrators, electrolytic cells	4–8
Clay products and cements:	
Enameling	4–8
Dairy products	4–8
Electric manufacturing:	
Storage battery, molding of grids	4–8

PRESENT STANDARDS OF ILLUMINATION—FOOT CANDLES.—(*Continued*)

	INTENSITY OF LIGHT IN FOOT CANDLES PER SQUARE FOOT
Forge shops and welding:	
Rough forging	4–8
Foundries:	
Rough molding and core making	4–8
Hat manufacturing:	
Dyeing, stiffening, braiding, cleaning and refining light	4–8
Ice making:	
Engine and compressor room	4–8
Inspecting:	
Rough	4–8
Leather manufacturing:	
Cutting, fleshing and stuffing	4–8
Machine shops:	
Rough bench and machine work	4–8
Packing:	
Medium	4–8
Paint manufacturing	4–8
Paper box manufacturing:	
Light	4–8
Paper manufacturing:	
Calendering	4–8
Soap manufacturing:	
Stamping, wrapping and packing, filling and packing soap powder	4–8
Automatic machines, rod, light and cold rolling, wire drawing, shearing, fine by line	4–8
Store and stock rooms:	
Medium	4–8
Structural steel fabrication	4–8
Textile mills:	
(Woolen)	
Twisting and dyeing	4–8
Drawing in, warping	
Light goods	4–8
School—Class room, study room, library	5–10
Store:	
Clothing, dry goods, haberdashery, millinery, jewelry, etc.	5–10
Industrial:	
Assembling	
Medium	5–10

PRESENT STANDARDS OF ILLUMINATION—FOOT CANDLES.—(*Continued*)

	Intensity of Light in Foot Candles per Square Foot
Bakeries	5–10
Candy making	5–10
Canning and preserving	5–10
Glass works:	
Grinding, glass blowing machines, cutting glass to size, silvering	5–10
Glove manufacturing:	
Light goods	
Cutting, pressing, knitting	5–10
Hat manufacturing:	
Forming, sizing, pouncing, flanging, finishing, ironing light	5–10
Laundries and dry cleaning	5–10
Leather working:	
Pressing and winding	
Light	5–10
Sheet metal works:	
Miscellaneous machines, ordinary bench work	5–10
Shoe manufacturing:	
Hand turning, miscellaneous bench and machine work	5–10
Store and stock rooms:	
Fine	5–10
Textile mills:	
(Cotton)	
Spooling, spinning, drawing in, warping, weaving, quilling, inspecting, knitting, slashing	5–10
(Silk)	
Winding, throwing, dyeing	5–10
(Woolen)	
Weaving	
Light goods	5–10
Wood working:	
Sizing, planing, rough sanding, medium machine and bench work, gluing, veneering, cooperage	5 10
Tobacco products	5 10
Meat packing:	
Cleaning, cutting, cooking, grinding, canning, packing	5–10
Milling and grain foods:	
Baking or roasting	5–10

PRESENT STANDARDS OF ILLUMINATION—FOOT CANDLES.—(*Continued*)

	INTENSITY OF LIGHT IN FOOT CANDLES PER SQUARE FOOT
Paint shops:	
Rubbing, ordinary hand painting and finishing	5–10
Paper box manufacturing:	
Dark	5–10
Polishing and burnishing	5–10
Printing industries:	
Matrixing and casting, miscellaneous machines, presses	5–10
Rubber manufacturing and products:	
Calenders, compounding mills, fabric preparation, stock cutting, tubing machines, solid tire operations, mechanical goods, building, vulcanizing	5–10
Paper manufacturing:	
Finishing, cutting and trimming	6–12
Printing industries:	
Proofreading, lithographing, electrotyping	6–12
Rubber manufacturing and products:	
Bead building, pneumatic tire building and finishing, inner tube operation, mechanical goods, trimming, treading	6–12
Sheet metal works:	
Punches, presses, shears, stamps, welders, spinning, fine bench work	6–12
Shoe manufacturing:	
Inspecting and sorting raw material, cutting, lasting and welding (light)	6–12
Textile mills:	
(Silk)	
Quilling, warping, weaving and finishing dark goods	6–12
(Woolen)	
Drawing in, warping	
Dark goods	6–12
Knitting machines	6–12
Wood working:	
Fine and bench and machine working, fine sanding and finishing	6–12
Store:	
First floor department, Corner	6–12
Office:	
Private, general	6–12
Industrial:	
Assembling	
Fine	6–12

PRESENT STANDARDS OF ILLUMINATION—FOOT CANDLES.—(*Continued*)

	INTENSITY OF LIGHT IN FOOT CANDLES PER SQUARE FOOT
Clay products and cements:	
Coloring and glazing	6–12
Cloth products:	
Light goods	6–12
Electric manufacturing:	
Coil and armature winding, mica working, insulating processes	6–12
Forge shops and welding:	
Fine forging and welding	6–12
Foundries:	
Fine molding and core making	6–12
Glass works:	
Fine grinding, polishing, beveling, inspecting, etching, and decorating	6–12
Glove manufacturing:	
Light goods	
Sorting, stitching, trimming and inspecting	6–12
Dark goods	
Cutting, pressing, knitting	6–12
Hat manufacturing:	
Dyeing, stiffening, braiding, cleaning and refining	6–12
Dark	
Forming, sizing, pouncing, flanging, finishing, ironing	
Dark	6–12
Sewing	
Light	6–12
Inspecting:	
Medium	6–12
Leather manufacturing:	
Finishing and scarfing	6–12
Leather working:	
Pressing and winding	
Dark	6–12
Grading, matching, cutting, scarfing, sewing	
Light	6–12
Machine shops:	
Medium bench and machine work, ordinary automatic machines, rough grinding, medium buffing and polishing	6–12
Packing:	
Fine	6–12

PRESENT STANDARDS OF ILLUMINATION—FOOT CANDLES.—(*Continued*)

	INTENSITY OF LIGHT IN FOOT CANDLES PER SQUARE FOOT
Paint shops:	
Fine hand painting and finishing	6–12
Office:	
Drafting room	10–20
Cloth products:	
Dark goods	10–20
Inspecting:	
Fine	10–20
Paint shops:	
Extra fine hand painting and finishing (automobile bodies, piano cases, etc.)	10–50

REFLECTION FACTORS OF DIFFERENT COLOR WALLS OR DECORATIONS

	PER CENT		PER CENT
White	81	Silver gray	50
Light gray	67	Buff	59
French gray	39	Tan	37
Dark gray	28	Chocolate brown	22
Lead	18	Sage green	47
Ivory white	76	Green	21
Caen stone	72	Olive green	14
Ivory	72	Sky blue	31
Primrose	67	Pink	51
Pearl gray	70	Cardinal red	27

Copper wire and cables fluctuated considerably in the last few years The average prices for wire and conduit are given in the following table:

COPPER WIRE, RUBBER COVERED DOUBLE BRAID (NEW CODE)
NET PRICE PER 1,000 FEET F.O.B. FACTORY (SINGLE CONDUCTOR)

Size, A. W. G.	Price, solid	Price, stranded
14	$14.00	$ 18.00
12	17.00	24.00
10	28.00	31.00
8	34.00	42.00
6	51.00	56.00
4	62.00	78.00
2	.....	95.00
1	.....	127.00
0	.....	150.00
00	.....	193.00
000	.....	234.00
0000	.....	283.00

RIGID CONDUIT PRICE PER FOOT F.O.B. FACTORY

Size	List price	Net price, black	Net price, galvanized
¼	$0.08½	0.05	0.055
⅜	0.08½	0.05	0.055
½	0.08½	0.05	0.055
¾	0.11½	0.06	0.07
1	0.17	0.09	0.10
1¼	0.23	0.125	0.135
1½	0.27½	0.15	0.16
2	0.37	0.20	0.22
2½	0.58½	0.32	0.36
3	0.76½	0.42	0.47
3½	0.92	0.51	0.58
4	1.09	0.62	0.69
4½	1.27	0.73	0.81
5	1.48	0.85	0.93
6	1.92	1.09	1.21

STANDARD SYMBOLS FOR WIRING PLANS

AS ADOPTED AND RECOMMENDED BY

THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION OF THE UNITED STATES and THE AMERICAN INSTITUTE OF ARCHITECTS,

Copies may be had on application to the Sec'y of The Nat. Elec. Cont. Assoc'n, Utica, N. Y., and the Sec'y of The American Instit. of Architects, Washington, D. C.

Ceiling outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Ceiling Outlet; Combination. ½ indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners. If gas only

Bracket Outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Bracket Outlet; Combination. ½ indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners. If gas only

Wall or Baseboard Receptacle Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Floor Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Outlet for Outdoor Standard or Pedestal; Electric only. Numeral indicates number of Stand. 16 C. P. Lamps.

Outlet for Outdoor Standard or Pedestal; Combination. ½ indicates 6-16 C. P. Stand. Incan. Lamps; 6 Gas Burners.

Drop Cord Outlet.

One Light Outlet, for Lamp Receptacle.

Arc Lamp Outlet.

Special Outlet, for Lighting, Heating and Power Current, as described in Specifications.

Ceiling Fan Outlet.

S^1 S. P. Switch Outlet.
S^2 D. P. Switch Outlet.
S^3 3-Way Switch Outlet.
S^4 4-Way Switch Outlet.
S^D Automatic Door Switch Outlet.
S^E Electrolier Switch Outlet.

Show as many Symbols as there are Switches. Or in case of a very large group of Switches, indicate number of Switches by a Roman numeral, thus: S^{XII} meaning 12 Single Pole Switches.

Describe Type of Switch in Specifications, that is, Flush or Surface, Push Button or Snap.

Meter Outlet.

Distribution Panel.

Junction or Pull Box.

Motor Outlet; Numeral in center indicates Horse Power.

Motor Control Outlet.

Transformer.

Main or Feeder run concealed under Floor.

Main or Feeder run concealed under Floor above.

Main or Feeder run exposed.

Branch Circuit run concealed under Floor.

Branch Circuit run concealed under Floor above.

Branch Circuit run exposed.

Pole Line.

Riser.

Telephone Outlet; Private Service.

Telephone Outlet; Public Service.

Bell Outlet.

Buzzer Outlet.

Push Button Outlet; Numeral indicates number of Pushes.

Annunciator; Numeral indicates number of Points.

Speaking Tube.

Watchman Clock Outlet.

Watchman Station Outlet.

Master Time Clock Outlet.

Secondary Time Clock Outlet.

Door Opener.

Special Outlet; for Signal Systems, as described in Specifications.

Battery Outlet.

Circuit for Clock, Telephone, Bell or other Service, run under Floor, concealed. Kind of Service wanted ascertained by Symbol to which line connects.

Circuit for Clock, Telephone, Bell or other Service, run under Floor above, concealed. Kind of Service wanted ascertained by Symbol to which line connects.

NOTE—If other than Standard 16 C. P. Incandescent lamps are desired, Specifications should describe capacity of Lamp to be used.

SUGGESTIONS IN CONNECTION WITH STANDARD SYMBOLS FOR WIRING PLANS

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

It is desirable that a key to the symbols used accompany all plans.

If mains, feeders, branches and distribution panels are shown on the plans, it is desirable that they be designated by letters or numbers.

Heights of Centre of Wall Outlets (unless otherwise specified)

Living Rooms	5′ 6″
Chambers	5′ 0″
Offices	6′ 0″
Corridors	6′ 3″

Height of Switches (unless otherwise specified) 4′ 0″

FIG. 1.

CHAPTER XXVI

USEFUL DATA

WAGE TABLE

To ascertain the amount due for wages in excess of $1.25 per hour, use the column of hours as the $1 rate, and add the rate for the odd cents, *i.e.*: if the wage for 30 hr. at $1.27½ is required, place a straight edge under 30 hr. and add 30, 0.150 and 8.10, making a total of $38.25.

Hours	Rate per hour, cents															
	½	25	26	27	28	29	30	31	32	33	34	35	36	37	38	
¼	.....	0.063	0.065	0.068	0.070	0.073	0.075	0.078	0.080	0.083	0.085	0.088	0.090	0.093	0.095	
½	.....	0.125	0.130	0.135	0.140	0.145	0.150	0.155	0.160	0.165	0.170	0.175	0.180	0.185	0.190	
¾	0.094	0.188	0.195	0.203	0.210	0.218	0.225	0.233	0.240	0.248	0.255	0.263	0.270	0.278	0.285	
2	0.010	0.50	0.52	0.54	0.56	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74	0.76	
3	0.015	0.75	0.78	0.81	0.84	0.87	0.90	0.93	0.96	0.99	1.02	1.05	1.08	1.11	1.14	
4	0.020	1.00	1.04	1.08	1.12	1.16	1.20	1.24	1.28	1.32	1.36	1.40	1.44	1.48	1.52	
5	0.025	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	
6	0.030	1.50	1.56	1.62	1.68	1.74	1.80	1.86	1.92	1.98	2.04	2.10	2.16	2.22	2.28	
7	0.035	1.75	1.82	1.89	1.96	2.03	2.10	2.17	2.24	2.31	2.38	2.45	2.52	2.59	2.66	
8	0.040	2.00	2.08	2.16	2.24	2.32	2.40	2.48	2.56	2.64	2.72	2.80	2.88	2.96	3.04	
9	0.045	2.25	2.34	2.43	2.52	2.61	2.70	2.79	2.88	2.97	3.06	3.15	3.24	3.33	3.42	
10	0.050	2.50	2.60	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40	3.50	3.60	3.70	3.80	
11	0.055	2.75	2.86	2.97	3.08	3.19	3.30	3.41	3.52	3.63	3.74	3.85	3.96	4.07	4.18	
12	0.060	3.00	3.12	3.24	3.36	3.48	3.60	3.72	3.84	3.96	4.08	4.20	4.32	4.44	4.56	
13	0.065	3.25	3.38	3.51	3.64	3.77	3.90	4.03	4.16	4.29	4.42	4.55	4.68	4.81	4.94	
14	0.070	3.50	3.64	3.78	3.92	4.06	4.20	4.34	4.48	4.62	4.76	4.90	5.04	5.18	5.32	
15	0.075	3.75	3.90	4.05	4.20	4.35	4.50	4.65	4.80	4.95	5.10	5.25	5.40	5.55	5.70	
16	0.080	4.00	4.16	4.32	4.48	4.64	4.80	4.96	5.12	5.28	5.44	5.60	5.76	5.92	6.08	
17	0.085	4.25	4.42	4.59	4.76	4.93	5.10	5.27	5.44	5.61	5.78	5.95	6.12	6.29	6.46	
18	0.090	4.50	4.68	4.86	5.04	5.22	5.40	5.58	5.76	5.94	6.12	6.30	6.48	6.66	6.84	
19	0.095	4.75	4.94	5.13	5.32	5.51	5.70	5.89	6.08	6.27	6.46	6.65	6.84	7.03	7.22	
20	0.100	5.00	5.20	5.40	5.60	5.80	6.00	6.20	6.40	6.60	6.80	7.00	7.20	7.40	7.60	
21	0.105	5.25	5.46	5.67	5.88	6.09	6.30	6.51	6.72	6.93	7.14	7.35	7.56	7.77	7.98	
22	0.110	5.50	5.72	5.94	6.16	6.38	6.60	6.82	7.04	7.26	7.48	7.70	7.92	8.14	8.36	
23	0.115	5.75	5.98	6.21	6.44	6.67	6.90	7.13	7.36	7.59	7.82	8.05	8.28	8.51	8.74	
24	0.120	6.00	6.24	6.48	6.72	6.96	7.20	7.44	7.68	7.92	8.16	8.40	8.64	8.88	9.12	
25	0.125	6.25	6.50	6.75	7.00	7.25	7.50	7.75	8.00	8.25	8.50	8.75	9.00	9.25	9.50	
26	0.130	6.50	6.76	7.02	7.28	7.54	7.80	8.06	8.32	8.58	8.84	9.10	9.36	9.62	9.88	
27	0.135	6.75	7.02	7.29	7.56	7.83	8.10	8.37	8.64	8.91	9.18	9.45	9.72	9.99	10.26	
28	0.140	7.00	7.28	7.56	7.84	8.12	8.40	8.68	8.96	9.24	9.52	9.80	10.08	10.36	10.64	
29	0.145	7.25	7.54	7.83	8.12	8.41	8.70	8.99	9.28	9.57	9.86	10.15	10.44	10.73	11.02	
30	0.150	7.50	7.80	8.10	8.40	8.70	9.00	9.30	9.60	9.90	10.20	10.50	10.80	11.10	11.40	
31	0.155	7.75	8.06	8.37	8.68	8.99	9.30	9.61	9.92	10.23	10.54	10.85	11.16	11.47	11.78	
32	0.160	8.00	8.32	8.64	8.96	9.28	9.60	9.92	10.24	10.56	10.88	11.20	11.52	11.84	12.16	
33	0.165	8.25	8.58	8.91	9.24	9.57	9.90	10.23	10.56	10.89	11.22	11.55	11.88	12.21	12.54	
34	0.170	8.50	8.84	9.18	9.52	9.86	10.20	10.54	10.88	11.22	11.56	11.90	12.24	12.58	12.92	
35	0.175	8.75	9.10	9.45	9.80	10.15	10.50	10.85	11.20	11.55	11.90	12.25	12.60	12.95	13.30	
36	0.180	9.00	9.36	9.72	10.08	10.44	10.80	11.16	11.52	11.88	12.24	12.60	12.96	13.32	13.68	
37	0.185	9.25	9.62	9.99	10.36	10.73	11.10	11.47	11.84	12.21	12.58	12.95	13.32	13.69	14.06	
38	0.190	9.50	9.88	10.26	10.64	11.02	11.40	11.78	12.16	12.54	12.92	13.30	13.68	14.06	14.44	
39	0.195	9.75	10.14	10.53	10.92	11.31	11.70	12.09	12.48	12.87	13.26	13.65	14.04	14.43	14.82	
40	0.200	10.00	10.40	10.80	11.20	11.60	12.00	12.40	12.80	13.20	13.60	14.00	14.40	14.80	15.20	
41	0.205	10.25	10.66	11.07	11.48	11.89	12.30	12.71	13.12	13.53	13.94	14.35	14.76	15.17	15.58	
42	0.210	10.50	10.92	11.34	11.76	12.18	12.60	13.02	13.44	13.86	14.28	14.70	15.12	15.54	15.96	
43	0.215	10.75	11.18	11.61	12.04	12.47	12.90	13.33	13.76	14.19	14.62	15.05	15.48	15.91	16.34	
44	0.220	11.00	11.44	11.88	12.32	12.76	13.20	13.64	14.08	14.52	14.96	15.40	15.84	16.28	16.72	
45	0.225	11.25	11.70	12.15	12.60	13.05	13.50	13.95	14.40	14.85	15.30	15.75	16.20	16.65	17.10	
46	0.230	11.50	11.96	12.42	12.88	13.34	13.80	14.26	14.72	15.18	15.64	16.10	16.56	17.02	17.48	
47	0.235	11.75	12.22	12.69	13.16	13.63	14.10	14.57	15.04	15.51	15.98	16.45	16.92	17.39	17.86	
48	0.240	12.00	12.48	12.96	13.44	13.92	14.40	14.88	15.36	15.84	16.32	16.80	17.28	17.76	18.24	
49	0.245	12.25	12.74	13.23	13.72	14.21	14.70	15.19	15.68	16.17	16.66	17.15	17.64	18.13	18.62	
50	0.250	12.50	13.00	13.50	14.00	14.50	15.00	15.50	16.00	16.50	17.00	17.50	18.00	18.50	19.00	
51	0.255	12.75	13.26	13.77	14.28	14.79	15.30	15.81	16.32	16.83	17.34	17.85	18.36	18.87	19.38	
52	0.260	13.00	13.52	14.04	14.56	15.08	15.60	16.12	16.64	17.16	17.68	18.20	18.72	19.24	19.76	
53	0.265	13.25	13.78	14.31	14.84	15.37	15.90	16.43	16.96	17.49	18.02	18.55	19.08	19.61	20.14	
54	0.270	13.50	14.04	14.58	15.12	15.66	16.20	16.74	17.28	17.82	18.36	18.90	19.44	19.98	20.52	
55	0.275	13.75	14.30	14.85	15.40	15.95	16.50	17.05	17.60	18.15	18.70	19.25	19.80	20.35	20.90	
56	0.280	14.00	14.56	15.12	15.68	16.24	16.80	17.36	17.92	18.48	19.04	19.60	20.16	20.72	21.28	
57	0.285	14.25	14.82	15.39	15.96	16.53	17.10	17.67	18.24	18.81	19.38	19.95	20.52	21.09	21.66	
58	0.290	14.50	15.08	15.66	16.24	16.82	17.40	17.98	18.56	19.14	19.72	20.30	20.88	21.46	22.04	
59	0.295	14.75	15.34	15.93	16.52	17.11	17.70	18.29	18.88	19.47	20.06	20.65	21.24	21.83	22.42	
69	0.300	15.00	15.60	16.20	16.80	17.40	18.00	18.60	19.20	19.80	20.40	21.00	21.60	2.20	22.80	

WAGE TABLE.—(*Continued*)

Hours	Rate per hour, cents															
	½	39	40	41	42	43	44	45	46	47	48	49	50	51	52	
¼	.....	0.098	0.100	0.103	0.105	0.108	0.110	0.113	0.115	0.118	0.120	0.123	0.125	0.128	0.130	
½	.....	0.195	0.200	0.205	0.210	0 215	0.220	0.225	0.230	0.235	0.240	0.245	0.250	0.255	0.260	
¾	0.004	0.293	0.300	0.308	0.315	0.323	0.330	0.338	0.345	0.353	0.360	0.368	0.375	0.383	0.390	
2	0.010	0.78	0.80	0.82	0.84	0.86	0.88	0.90	0.92	0.94	0.96	0.98	1.00	1.02	1.04	
3	0.015	1.17	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.50	1.53	1.56	
4	0.020	1.56	1.60	1.64	1.68	1.72	1.76	1.80	1.84	1.88	1.92	1.96	2.00	2.04	2.08	
5	0.025	1.95	2.00	2.05	2.10	2 15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	
6	0.030	2.34	2.40	2.46	2.52	2.58	2.64	2.70	2.76	2.82	2.88	2.94	3.00	3.06	3.12	
7	0.035	2.73	2.80	2.87	2.94	3.01	3.08	3.15	3.22	3.29	3.36	3.43	3.50	3.57	3.64	
8	0.040	3.12	3.20	3.28	3.36	3.44	3.52	3.60	3.68	3.76	3.84	3.92	4.00	4.08	4.16	
9	0.045	3.51	3.60	3.69	3.78	3.87	3.96	4.05	4.14	4.23	4.32	4.41	4.50	4.59	4.68	
10	0.050	3.90	4.00	4.10	4.20	4.30	4.40	4.50	4.60	4.70	4.80	4.90	5.00	5.10	5.20	
11	0.055	4.29	4.40	4.51	4.62	4.73	4.84	4.95	5.06	5.17	5.28	5.39	5.50	5.61	5.72	
12	0.060	4.68	4.80	4.92	5.04	5.16	5.28	5.40	5.52	5.64	5.76	5.88	6.00	6.12	6.24	
13	0.065	5.07	5.20	5.33	5.46	5.59	5.72	5.85	5.98	6.11	6.24	6.37	6.50	6.63	6.76	
14	0.070	5.46	5.60	5.74	5.88	6.02	6.16	6.30	6.44	6.58	6.72	6.86	7.00	7.14	7.28	
15	0.075	5.85	6.00	6.15	6.30	6.45	6.60	6.75	6.90	7 05	7.20	7.35	7.50	7.65	7.80	
16	0.080	6.24	6.40	6.56	6.72	6.88	7.04	7.20	7.36	7.52	7.68	7.84	8.00	8.16	8.32	
17	0.085	6.63	6.80	6.97	7.14	7.31	7.48	7.65	7.82	7.99	8.16	8.33	8.50	8.67	8.84	
18	0.090	7.02	7.20	7.38	7.56	7.74	7.92	8.10	8.28	8.46	8.64	8.82	9.00	9.18	9.36	
19	0.095	7.41	7.60	7.79	7.98	8.17	8.36	8.55	8.74	8.93	9.12	9.31	9.50	9.69	9.88	
20	0.100	7.80	8.00	8.20	8.40	8.60	8.80	9.00	9.20	9.40	9.60	9.80	10.00	10.20	10.40	
21	0.105	8.19	8.40	8.61	8.82	9.03	9.24	9.45	9.66	9.87	10.08	10.29	10.50	10.71	10.92	
22	0.110	8.58	8 80	9.02	9.24	9 46	9.68	9 90	10.12	10.34	10.56	10.78	11.00	11.22	11.44	
23	0.115	8.97	9.20	9.43	9.66	9.89	10.12	10.35	10.58	10.81	11.04	11.27	11.50	11.73	11.96	
24	0.120	9.36	9.60	9.84	10.08	10.32	10.56	10.80	11.04	11.28	11.52	11.76	12.00	12.24	12.48	
25	0.125	9.75	10.00	10.25	10.50	10.75	11.00	11.25	11.50	11.75	12.00	12.25	12.50	12.25	13.00	
26	0.130	10.14	10.40	10.66	10.92	11.18	11.44	11.70	11.96	12.22	12.48	12.74	13.00	13.26	13.52	
27	0.135	10.53	10.80	11.07	11.34	11.61	11.88	12.15	12.42	12.69	12.96	13.23	13.50	13.77	14.04	
28	0.140	10.92	11.20	11.48	11.76	12.04	12.32	12.60	12.88	13.16	13.44	13.72	14.00	14.28	14.56	
29	0.145	11.31	11.60	11.89	12.18	12.47	12 76	13.05	13.34	13.63	13.92	14.21	14.50	14.79	15.08	
30	0.150	11.70	12.00	12.30	12.60	12.90	13.20	13.50	13.80	14.10	14.40	14.70	15.00	15.30	15.60	
31	0.155	12.09	12.40	12.71	13.02	13.33	13.64	13.95	14.26	14.57	14.88	15.19	15.50	15.81	16.12	
32	0.160	12.48	12.80	13.12	13.44	13.76	14.08	14.40	14.72	15.04	15.36	15.68	16.00	16.32	16.64	
33	0.165	12.87	13.20	13.53	13.86	14.19	14.52	14.85	15.18	15.51	15.84	16.17	16.50	16.83	17.16	
34	0.170	13.26	13.60	13.94	14.28	14.62	14.96	15.30	15.64	15.98	16.32	16.66	17.00	17.34	17.68	
35	0.175	13.65	14.00	14.35	14.70	15.05	15.40	15.75	16.10	16.45	16.80	17.15	17.50	17.85	18.20	
36	0.180	14.04	14.40	14.76	15.12	15.48	15.84	16.20	16.56	16.92	17.28	17.64	18.00	18.36	18.72	
37	0.185	14.43	14.80	15.17	15.54	15.91	16.28	16.65	17.02	17.39	17.76	18.13	18.50	18.87	19.24	
38	0.190	14.82	15.20	15.58	15.96	16.34	16.72	17.10	17.48	17.86	18.24	18.62	19.00	19.38	19.76	
39	0.195	15.21	15.60	15.99	16.38	16.77	17.16	17.55	17.94	18.33	18.72	19.11	19.50	19.89	20.28	
40	0.200	15.60	16.00	16.40	16.80	17.20	17.60	18.00	18.40	18.80	19.20	19.60	20.00	20.40	20.80	
41	0.205	15.99	16.40	16.81	17.22	17.63	18.04	18.45	18.86	19.27	19.68	20.09	20.50	20.91	21 32	
42	0.210	16.38	16.80	17.22	17.64	18.06	18.48	18.90	19 32	19.74	20.16	20.58	21.00	21.42	21.84	
43	0.215	16.77	17.20	17.63	18.06	18.49	18.92	19.35	19.78	20.21	20.64	21.07	21.50	21.93	22.36	
44	0.220	17.16	17.60	18.04	18.48	18.92	19.36	19.80	20.24	20.68	21.12	21.56	22.00	22.44	22.88	
45	0.225	17.55	18.00	18.45	18.90	19.35	19.80	20.25	20.70	21.15	21.60	22.05	22.50	22.95	23.40	
46	0.230	17.94	18.40	18.86	19.32	19.78	20.24	20.70	21.16	21.62	22.08	22.54	23.00	23.46	23.92	
47	0.235	18.33	18.80	19.27	19.74	20.21	20.68	21.15	21.62	22.09	22.56	23.03	23.50	23.97	24.44	
48	0.240	18.72	19.20	19.68	20.16	20.64	21.12	21.60	22.08	22.56	23.04	23.52	24.00	24.48	24.96	
49	0.245	19.11	19.60	20.09	20.58	21.07	21.56	22.05	22.54	23.03	23.52	24.01	24.50	24.99	25.48	
50	0.250	19.50	20.00	20.50	21.00	21.50	22.00	22.50	23.00	23.50	24.00	24.50	25.00	25.50	26.00	
51	0.255	19.89	20.40	20.91	21.42	21.93	22.44	22.95	23.46	23.97	24.48	24.99	25.50	26.01	26.52	
52	0.260	20.28	20.80	21.32	21.84	22.36	22.88	23.40	23.92	24.44	24.96	25.48	26.00	26.52	27.04	
53	0.265	20.67	21.20	21.73	22.26	22.79	23.32	23.85	24.38	24.91	25.44	25.97	26.50	27.03	27.56	
54	0.270	21.06	21.60	22.14	22.68	23.22	23.76	24.30	24.84	25.38	25.92	26.46	27.00	27.54	28.08	
55	0.275	21.45	22.00	22.55	23.10	23.65	24.20	24.75	25.30	25.85	26 40	26.95	27.50	28.05	28.60	
56	0.280	21.84	22.40	22.96	23.52	24.08	24.64	25.20	25 76	26.32	26.88	27.44	28.00	28.56	29.12	
57	0.285	22 23	22.80	23.37	23.94	24.51	25 08	25.65	26.22	26.79	27.36	27.93	28.50	29.07	29.64	
58	0.290	22.62	23.20	23.78	24.36	24.94	25.52	26.10	26.68	27.26	27.84	28.42	29.00	29.58	30.16	
59	0.295	23.01	23.60	24.19	24.78	25.37	25.96	26.55	27.14	27.73	28.32	28.91	29.50	30.09	30.60	
60	0.300	23.40	24.00	24.60	25.20	25.80	26.40	27.00	27.60	28.20	28.80	29.40	30.00	30.60	31.20	

WAGE TABLE.—*(Continued)*

Hours	Rate per hour, cents															
	½	53	54	55	56	57	58	59	60	61	62	63	64	65	66	
¼	.....	0.133	0.135	0.138	0.140	0.143	0.145	0.148	0.150	0.153	0.155	0.158	0.160	0.163	0.165	
½	.....	0.265	0.270	0.275	0.280	0.285	0.290	0.295	0.300	0.305	0.310	0.315	0.320	0.325	0.330	
¾	0.004	0.398	0.405	0.413	0.420	0.428	0.435	0.443	0.450	0.458	0.465	0.473	0.480	0.488	0.495	
2	0.010	1 06	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	
3	0 015	1.59	1.62	1.65	1.68	1.71	1.74	1.77	1.80	1.83	1.86	1.89	1.92	1.95	1.98	
4	0.020	2 12	2.16	2.20	2.24	2.28	2.32	2.36	2.40	2.44	2.48	2.52	2.56	2.60	2.64	
5	0.025	2.65	2.70	2 75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	
6	0 030	3 18	3 24	3 30	3 36	3.42	3.48	3.54	3.60	3 66	3.72	3.78	3.84	3.90	3.96	
7	0.035	3 71	3 78	3 85	3.92	3.99	4.06	4.13	4.20	4.27	4.34	4.41	4.48	4.55	4.62	
8	0.040	4.24	4 32	4 40	4.48	4.56	4.64	4.72	4.80	4.88	4.96	5.04	5.12	5.20	5.28	
9	0.045	4 77	4 86	4 95	5.04	5.13	5.22	5.31	5.40	5.49	5.58	5.67	5.76	5.85	5.94	
10	0 050	5 30	5 40	5 50	5.60	5.70	5 80	5.90	6.00	6.10	6.20	6.30	6.40	6.50	6.60	
11	0 055	5 83	5 94	6 05	6 16	6 27	6.38	6.49	6.60	6.71	6.82	6.93	7.04	7.15	7.26	
12	0 060	6 36	6 48	6 60	6.72	6 84	6.96	7.08	7.20	7.32	7.44	7.56	7.68	7.80	7.92	
13	0 065	6 89	7 02	7 15	7 28	7.41	7.54	7.67	7 80	7.93	8.06	8.19	8.32	8.45	8.58	
14	0 070	7 42	7 56	7 70	7 84	7.98	8.12	8 26	8.40	8.54	8.68	8.82	8.96	9.10	9.24	
15	0 075	7 95	8 10	8 25	8 40	8 55	8.70	8.85	9.00	9.15	9.30	9.45	9.60	9.75	9.90	
16	0.080	8 48	8 64	8 80	8 96	9 12	9.28	9.44	9 60	9.76	9.92	10.08	10.24	10.40	10.56	
17	0 085	9 01	9 18	9 35	9 52	9 69	9.86	10 03	10.20	10.37	10.54	10.71	10.88	11.05	11.22	
18	0 090	9 54	9 72	9.90	10 08	10.26	10.44	10.62	10.80	10.98	11.16	11.34	11.52	11.70	11.88	
19	0 095	10.07	10.26	10.45	10.64	10 83	11.02	11.21	11.40	11.59	11.78	11.97	12.16	12.35	12.54	
20	0.100	10.60	10.80	11.00	11.20	11.40	11.60	11.80	12.00	12.20	12.40	12.60	12.80	13.00	13.20	
21	0 105	11.13	11.34	11.55	11.76	11.97	12.18	12.39	12.60	12.81	13.02	13.23	13.44	13.65	13.86	
22	0 110	11.66	11.88	12.10	12 32	12.54	12.76	12.98	13 20	13.42	13.64	13.86	14.08	14.30	14.52	
23	0.115	12.19	12.42	12.65	12.88	13.11	13.34	13.57	13.80	14.03	14.26	14.49	14.72	14.95	15.18	
24	0.120	12.72	12.96	13.20	13.44	13.68	13.92	14.16	14.40	14.64	14.88	15.12	15.36	15.60	15.84	
25	0.125	13.25	13.50	13.75	14 00	14.25	14.50	14.75	15.00	15.25	15.50	15.75	16.00	16.25	16.50	
26	0.130	13.78	14.04	14.30	14.56	14.82	15.08	15.34	15.60	15.86	16.12	16.38	16.64	16.90	17.16	
27	0.135	14.31	14.58	14.85	15.12	15.39	15.66	15.93	16.20	16.47	16.74	17.01	17.28	17.55	17.82	
28	0.140	14.84	15.12	15.40	15.68	15.96	16.24	16.52	16.80	17.08	17.36	17.64	17.92	18.20	18.48	
29	0.145	15.37	15.66	15.95	16.24	16.53	16.82	17.11	17.40	17.69	17.98	18.27	18.56	18.85	19.14	
30	0.150	15.90	16.20	16.50	16.80	17.10	17.40	17.70	18.00	18.30	18.60	18.90	19.20	19.50	19.80	
31	0.155	16.43	16.74	17.05	17.36	17.67	17.98	18.29	18.60	18.91	19.22	19.53	19.84	20.15	20 46	
32	0.160	16.96	17.28	17.60	17.92	18.24	18.56	18.88	19.20	19.52	19.84	20.16	20.48	20.80	21.12	
33	0.165	17.49	17.82	18.15	18.48	18.81	19.14	19.47	19.80	20.13	20.46	20.79	21.12	21.45	21 78	
34	0.170	18.02	18.36	18.70	19.04	19.38	19.72	20.06	20.40	20.74	21.08	21.42	21.76	22.10	22.44	
35	0.175	18.55	18.90	19.25	19.60	19.95	20.30	20.65	21.00	21.35	21.70	22.05	22.40	22.75	23.10	
36	0.180	19.08	19.44	19.80	20.16	20.52	20.88	21.24	21.60	21.96	22.32	22.68	23.04	23.40	23 76	
37	0.185	19.61	19.98	20.35	20.72	21.09	21.46	21.83	22.20	22.57	22.94	23.31	23.68	24.05	24.42	
38	0.190	20.14	20.52	20.90	21.28	21.66	22.04	22.42	22.80	23.18	23.56	23.94	24.32	24.70	25 08	
39	0.195	20.67	21.06	21.45	21.84	22.23	22.62	23.01	23.40	23.79	24.18	24.57	24.96	25.35	25.74	
40	0.200	21.20	21.60	22.00	22.40	22.80	23.20	23.60	24.00	24.40	24.80	25.20	25.60	26 00	26.40	
41	0.205	21.73	22.14	22.55	22.96	23.37	23.78	24.19	24.60	25.01	25.42	25.83	26.24	26.65	27.06	
42	0.210	22.26	22.68	23.10	23.52	23.94	24.36	24.78	25.20	25.62	26.04	26.46	26.88	27.30	27.72	
43	0.215	22.79	23.22	23.65	24.08	24.51	24.94	25.37	25.80	26.23	26.66	27.09	27.52	27.95	28.38	
44	0.220	23.32	23.76	24.20	24.64	25.08	25.52	25.96	26.40	26.84	27.28	27.72	28.16	28.60	29.04	
45	0.225	23.85	24.30	24.75	25.20	25 65	26 10	26.55	27.00	27.45	27.90	28.35	28.80	29.25	29.70	
46	0.230	24.38	24.84	25.30	25.76	26.22	26.68	27.14	27.60	28.06	28.52	28.98	29.44	29.90	30.36	
47	0.235	24.91	25.38	25.85	26.32	26.79	27.26	27.73	28.20	28.67	29.14	29.61	30.08	30.55	31.02	
48	0.240	25.44	25.92	26.40	26.88	27.36	28.84	28.32	28.80	29.28	29.76	30.24	30.72	31.20	31.68	
49	0.245	25.97	26.46	26.95	27.44	27.93	28.42	28.91	29.40	29.89	30.38	30.87	31.36	31.85	32.34	
50	0.250	26.50	27.00	27.50	28.00	28.50	29.00	29.50	30.00	30 50	31.00	31 50	32.00	32 50	33.00	
51	0.255	27.03	27.54	28.05	28.56	29.07	29.58	30.09	30.60	31.11	31 62	32.13	32.64	33.15	33.66	
52	0.260	27.56	28.08	28.60	29.12	29.64	30.16	30 68	31.20	31.72	32.24	32.76	33 28	33.80	34.32	
53	0.265	28.09	28.62	29.15	29.68	30.21	30.74	31.27	31.80	32.33	32.86	33.39	33.92	34.45	34.98	
54	0.270	28.62	29.16	29.70	30.24	30.78	31 32	31.86	32.40	32.94	33.48	34.02	34.56	35.10	35 64	
55	0.275	29.15	29.70	30.25	31.80	31.35	31.90	32.45	33.00	33.55	34.10	34.65	35.20	35.75	36.30	
56	0.280	29.68	30.24	30.80	31.36	31.92	32.48	33.04	33.60	34.16	34.72	35.28	35.84	36.40	36.96	
57	0.285	30.21	30.78	31.35	31.92	32.49	33.06	33.63	34.20	34.77	35.34	35.91	36.48	37.05	37.62	
58	0.290	30.74	31.32	31.90	32.48	33.06	33.64	34.22	34.80	35.38	35.96	36.54	37.12	37.70	38.28	
59	0.295	31.27	31.86	32.45	33.04	33.63	34.22	34.81	35.40	35.99	36.58	37.17	37.76	38.35	38.94	
60	0.300	31.80	32.40	33.00	33.60	34.20	34.80	35.40	36.00	36.60	37.20	37.80	38.40	39.00	39.60	

WAGE TABLE.—*(Continued)*

Hours	Rate per hour, cents														
	½	67	68	69	70	71	72	73	74	75	76	77	78	79	80
¼	.....	0.168	0.170	0.173	0.175	0.178	0.180	0.183	0.185	0.188	0.190	0.193	0.195	0.198	0.200
½	.....	0.335	0 340	0.345	0.350	0.355	0.360	0.365	0.370	0.375	0.380	0.385	0.390	0.395	0.400
¾	0.004	0.503	0.510	0.518	0.525	0.533	0.540	0.548	0.555	0.563	0.570	0.578	0.585	0.593	0.600
2	0.010	1.34	1.36	1.38	1.40	1.42	1.44	1.46	1.48	1.50	1.52	1.54	1.56	1.58	1.60
3	0.015	2.01	2.04	2.07	2.10	2.13	2.16	2 19	2.22	2.25	2.28	2.31	2.34	2.37	2.40
4	0.020	2.68	2.72	2.76	2.80	2.84	2.88	2.92	2.96	3.00	3.04	3.08	3.12	3.16	3.20
5	0.025	3.35	3.40	3.45	3.50	3.55	3.60	3.65	3.70	3.75	3.80	3.85	3.90	3 95	4.00
6	0.030	4.02	4.08	4.14	4.20	4.26	4.32	4.38	4.44	4.50	4.56	4.62	4.68	4.74	4.80
7	0.035	4.69	4.76	4.83	4.90	4.97	5.04	5.11	5.18	5.25	5.32	5.39	5.46	5.53	5.60
8	0.040	5.36	5.44	5.52	5.60	5.68	5.76	5.84	5.92	6.00	6.08	6.16	6.24	6.32	6.40
9	0.045	6.03	6.12	6.21	6.30	6.39	6.48	6.57	6.66	6.75	6.84	6.93	7.02	7.11	7.20
10	0.050	6.70	6 80	6.90	7.00	7.10	7.20	7.30	7.40	7.50	7.60	7.70	7.80	7.90	8.00
11	0.055	7.37	7.48	7.59	7.70	7.81	7.92	8.03	8.14	8.25	8.36	8.47	8.58	8.69	8.80
12	0.060	8.04	8.16	8.28	8.40	8.52	8.64	8.76	8.88	9.00	9.12	9.24	9.36	9.48	9.60
13	0.065	8.71	8.84	8.97	9.10	9.23	9.36	9.49	9.62	9.75	9 88	10.01	10.14	10.27	10.40
14	0.070	9.38	9.52	9.66	9.80	9.94	10.08	10.22	10.36	10.50	10.64	10.78	10.92	11.06	11.20
15	0.075	10.05	10.20	10.35	10.50	10.65	10.80	10.95	11.10	11.25	11.40	11.55	11.70	11.85	12.00
16	0.080	10.72	10.88	11.04	11.20	11.36	11.52	11.68	11.84	12.00	12.16	12.32	12.48	12.64	12.80
17	0.085	11.39	11.56	11.73	11.90	12.07	12.24	12.41	12.58	12.75	12.92	13.09	13.26	13.43	13.60
18	0.090	12.06	12.24	12.42	12.60	12.78	12.96	13.14	13.32	13.50	13.68	13.86	14.04	14.22	14.40
19	0.095	12.73	12.92	13.11	13.30	13.49	13.68	13.87	14.06	14.25	14.44	14.63	14.82	15.01	15 20
20	0.100	13.40	13.60	13.80	14.00	14.20	14.40	14.60	14.80	15.00	15.20	15.40	15.60	15.80	16.00
21	0.105	14.07	14.28	14.49	14.70	14.91	15.12	15.33	15.54	15.75	15.96	16.17	16.38	16.59	16.80
22	0.110	14.74	14.96	15.18	15.40	15.62	15.84	16.06	16.28	16.50	16.72	16.94	17.16	17.38	17.60
23	0 115	15.41	15.64	15.87	16.10	16.33	16.56	16.79	17.02	17 25	17.48	17.71	17.94	18.17	18.40
24	0.120	16.08	16.32	16.56	16.80	17.04	17.28	17.52	17.76	18.00	18.24	18.48	18.72	18.96	19.20
25	0.125	16.75	17.00	17.25	17.50	17.75	18.00	18.25	18.50	18.75	19.00	19.25	19.50	19.75	20.00
26	0.130	17.42	17.68	17.94	18.20	18.46	18.72	18.98	19.24	19.50	19.76	20.02	20.28	20.54	20.80
27	0.135	18.09	18.36	18.63	18.90	19.17	19.44	19.71	19.98	20.25	20.52	20.79	21.06	21.33	21.60
28	0.140	18.76	19.04	19.32	19.60	19.88	20.16	20.44	20.72	21.00	21.28	21.56	21.84	22.12	22.40
29	0.145	19.43	19.72	20.01	20.30	20.59	20.88	21.17	21.46	21.75	22.04	22.33	22.62	22.91	23.20
30	0.150	20.10	20.40	20.70	21.00	21 30	21.60	21.90	22.20	22.50	22.80	23.10	23.40	23.70	24.00
31	0.155	20.77	21.08	21.39	21.70	22.01	22.32	22.63	22.94	23.25	23.56	23.87	24.18	24.49	24.80
32	0.160	21.44	21.76	22.08	22.40	22.72	23.04	23.36	23.68	24.00	24.32	24.64	24.96	25.28	25.60
33	0.165	22.11	22.44	22.77	23.10	23.43	23.76	24.09	24.42	24.75	25.08	25.41	25.74	26.07	26.40
34	0.170	22.78	23.12	23.46	23.80	24.14	24.48	24.82	25.16	25.50	25.84	26.18	26.52	26.86	27.20
35	0.175	23.45	23.80	24.15	24.50	24.85	25.20	25.55	25.90	26.25	26.60	26.95	27.30	27.65	28.00
36	0.180	24.12	24.48	24.84	25.20	25.56	25.92	26.28	26.64	27.00	27.36	27.72	28.08	28.44	28.80
37	0.185	24.79	25.16	25.53	25.90	26.27	26.64	27.01	27.38	27.75	28.12	28.49	28.86	29.23	29.60
38	0.190	25.46	25.84	26.22	26.60	26.98	27.36	27.74	28.12	28.50	28.88	29.26	29.64	30.02	30.40
39	0.195	26.13	26.52	26.91	27.30	27.69	28.08	28.47	28.86	29.25	29.64	30.03	30.42	30.81	31.20
40	0.200	26.80	27.20	27.60	28.00	28.40	28.80	29.20	29.60	30.00	30.40	30.80	31.20	31.60	32.00
41	0.205	27.47	27.88	28.29	28.70	29 11	29.52	29.93	30.34	30.75	31.16	31.57	31.98	32.39	32.80
42	0.210	28.14	28.56	28.98	29.40	29.82	30.24	30.66	31.08	31.50	31.92	32.34	32.76	33.18	33.60
43	0.215	28.81	29.24	29.67	30.10	30.53	30.96	31.39	31.82	32.25	32.68	33.11	33.54	33.97	34.40
44	0 220	29.48	29.92	30.36	30.80	31.24	31.68	32.12	32.56	33.00	33.44	33.88	34.32	34.76	35.20
45	0 225	30.15	30.60	31.05	31.50	31.95	32.40	32.85	33.30	33.75	34.20	34.65	35.10	35.55	36.00
46	0.230	30.82	31.28	31 74	32.20	32.66	33.12	33.58	34.04	34.50	34.96	35.42	35.88	36.34	36.80
47	0.235	31.49	31.96	32.43	32.90	33.37	33.84	34.31	34.78	35.25	35.72	36.19	36.66	37.13	37.60
48	0.240	32.16	32.64	33.12	33.60	34.08	34.56	35.04	35.52	36.00	36.48	36.96	37.44	37.92	38.40
49	0.245	32.83	33.32	33.81	34.30	34.79	35.28	35.77	36.26	36.75	37.24	37.73	38.22	38.71	39.20
50	0.250	33.50	34.00	34.50	35.00	35.50	36.00	36.50	37.00	37.50	38.00	38.50	39.00	39.50	40.00
51	0.255	34.17	34.68	35.19	35.70	36.21	36.72	37.23	37.74	38.25	38.76	39.27	39.78	40.29	40.80
52	0.260	34.84	35.36	35.88	36.40	36.92	37.44	37.96	38.48	39.00	39.52	40.04	40.56	41.08	41.60
53	0.265	35.51	36.04	36.57	37.10	37.63	38.16	38.69	39.22	39.75	40.28	40.81	41.34	41.87	42.40
54	0.270	36.18	36.72	37.26	37.80	38.34	38.88	39.42	39.96	40.50	41.04	41.58	42.12	42.66	43.20
55	0.275	36.85	37.40	37.95	38 50	39.05	39 60	40.15	40.70	41.25	41.80	42.35	42.90	43 45	44.00
56	0.280	37 52	38.08	38.64	39.20	39.76	40.32	40.88	41.44	42.00	42.56	43.12	43 68	44.24	44.80
57	0.285	38.19	38.76	39 33	39.90	40.47	41.04	41 61	42.18	42.75	43.32	43.89	44.46	45.03	45.60
58	0.290	38.86	39.44	40 02	40.60	41.18	41.76	42.34	42.92	43.50	44.08	44.66	45.24	45.82	46.40
59	0.295	39.53	40.12	40.71	41.30	41.89	42.48	43.07	43.66	44.25	44.84	45.43	46.02	46.61	47 20
60	0 300	40.20	40.80	41.40	42.00	42.60	43.20	43.80	44.40	45.00	45.60	46.20	46.80	47.40	48 00

WAGE TABLE.—(*Continued*)

Hours	Rate per hour, cents															
	½	81	82	83	84	85	86	87	88	89	90	91	92	93	94	
¼	. . .	0.203	0.205	0.208	0.210	0.213	0.215	0.218	0.220	0.223	0.225	0.228	0.230	0.233	0.235	
½	. . .	0.405	0.410	0.415	9.420	0.425	0 430	0.435	0.440	0.445	0.450	0.455	0.460	0.465	0.470	
¾	0.004	0 608	0.615	0 623	0 630	0.638	0.645	0.653	0 660	0.668	0.675	0.683	0.690	0.698	0.705	
2	0.010	1.62	1.64	1.66	1.68	1.70	1.72	1.74	1.76	1.78	1.80	1.82	1.84	1.86	1.88	
3	0.015	2.43	2.46	2.49	2.52	2.55	2.58	2.61	2.64	2.67	2.70	2.73	2.76	2.79	2.82	
4	0.020	3.24	3.28	3.32	3.36	3 40	3.44	3.48	3.52	3.56	3.60	3.64	3.68	3.72	3.76	
5	0.025	4.05	4.10	4.15	4.20	4.25	4.30	4.35	4.40	4.45	4.50	4.55	4.60	4.65	4.70	
6	0.030	4.86	4.92	4.98	5.04	5.10	5.16	5.22	5.28	5.34	5.40	5.46	5.52	5.58	5.64	
7	0.035	5.67	5.74	5.81	5.88	5.95	6.02	6.09	6.16	6.23	6.30	6.37	6.44	6.51	6.58	
8	0.040	6.48	6.56	6.64	6.72	6.80	6.88	6.96	7.04	7.12	7.20	7.28	7.36	7.44	7.52	
9	0.045	7.29	7.38	7.47	7.56	7.65	7.74	7.83	7.92	8.01	8.10	8.19	8.28	8.37	8.46	
10	0.050	8.10	8.20	8.30	8.40	8.50	8.60	8.70	8.80	8.90	9.00	9.10	9.20	9.30	9.40	
11	0.055	8.91	9 02	9.13	9.24	9.35	9.46	9.57	9.68	9.79	9.90	10.01	10.12	10.23	10.34	
12	0.060	9 72	9.84	9.96	10 08	10.20	10 32	10.44	10.56	10.68	10.80	10.92	11.04	11.16	11.28	
13	0.065	10.53	10.66	10 79	10.92	11.05	11.18	11.31	11.44	11.57	11.70	11.83	11.96	12 09	12.22	
14	0.070	11.34	11.48	11.62	11.76	11.90	12.04	12.18	12.32	12.46	12.60	12.74	12.88	13.02	13.16	
15	0.075	12.15	12.30	12 45	12 60	12.75	12.90	13.05	13.20	13.35	13.50	13.65	13.80	13.95	14.10	
16	0.080	12 96	13.12	13.28	13 44	13.60	13 76	13.92	14.08	14.24	14.40	14.56	14.72	14.88	15.04	
17	0.085	13.77	13.94	14.11	14.28	14 45	14.62	14.79	14.96	15.13	15.30	15.47	15.64	15.81	15.98	
18	0 090	14.58	14.76	14.94	15.12	15.30	15 48	15.66	15.84	16.02	16.20	16.38	16.56	16.74	16.92	
19	0.095	15.39	15.58	15.77	15.96	16 15	16.34	16.53	16.72	16.91	17.10	17.29	17.48	17.67	17.86	
20	0.100	16.20	16.40	16.60	16.80	17.00	17.20	17.40	17.60	17.80	18.00	18.20	18.40	18.60	18.80	
21	0 105	17.01	17.22	17.43	17.64	17.85	18.06	18.27	18.48	18.69	18.90	19 11	19.32	19.53	19.74	
22	0.110	17.82	18.04	18.26	18.48	18.70	18.92	19.14	19.36	19.58	19.80	20.02	20.24	20.46	20.68	
23	0.115	18.63	18.86	19.09	19.32	19.55	19.78	20.01	20.24	20.47	20.70	20.93	21.16	21.39	21.62	
24	0 120	19 44	19.68	19.92	20.16	20.40	20.64	20.88	21 12	21.36	21.60	21.84	22.08	22.32	22.56	
25	0.125	20.25	20.50	20.75	21.00	21.25	21.50	21.75	22.00	22.25	22.50	22.75	23.00	23.25	23.50	
26	0.130	21.06	21.32	21.58	21.84	22.10	22.36	22.62	22.88	23.14	23.40	23.66	23.92	24.18	24.44	
27	0.135	21.87	22 14	22.41	22.68	22.95	23.22	23.49	23.76	24.03	24.30	24.57	24.84	25.11	25.38	
28	0.140	22.68	22.96	23.24	23.52	23.80	24.08	24.36	24.64	24.92	25.20	25.48	25.76	26.04	26.32	
29	0 145	23.49	23.78	24.07	24.36	24.65	24.94	25.23	25.52	25.81	26.10	26.39	26.68	26.97	27.26	
30	0.150	24.30	24.60	24 90	25.20	25.50	25.80	26.10	26.40	26.70	27.00	27.30	27.60	27.90	28.20	
31	0.155	25.11	25.42	25.73	26.04	26.35	26.66	26 97	27.28	27.59	27.90	28.21	28.52	28.83	29.14	
32	0.160	25.92	26 24	26.56	26.88	27.20	27.52	27.84	28.16	28.48	28.80	29.12	29.44	29.76	30.08	
33	0.165	26.73	27.06	27.39	27 72	28.05	28.38	28 71	29.04	29.37	29.70	30.03	30.36	30.69	31.02	
34	0.170	27.54	27.88	28.22	28.56	28.90	29.24	29.58	29.92	30.26	30.60	30.94	31.28	31.62	31.96	
35	0.175	28.35	28 70	29.05	29 40	29.75	30.10	30.45	30.80	31.15	31.50	31 85	32.20	32.55	32.90	
36	0.180	29.16	29 52	29.88	30.24	30.60	30.96	31.32	31.68	32.04	32.40	32 76	33.12	33.48	33.84	
37	0.185	29.97	30.34	30.71	31.08	31.45	31.82	32.19	32.56	32.93	33.30	33.67	34.04	34.41	34.78	
38	0.190	30.78	31.16	31.54	31.92	32.30	32.68	33.06	33.44	33.82	34.20	34.58	34.96	35.34	35.72	
39	0.195	31.59	31 98	32.37	32.76	33.15	33.54	33.93	34.32	34.71	35 10	35.49	35.88	36.27	36 66	
40	0.200	32.40	32.80	33.20	33.60	34.00	34.40	34.80	35.20	35.60	36 00	36.40	36.80	37.20	37 60	
41	0.205	33.21	33 62	34.03	34.44	34.85	35.26	35.67	36 08	36.49	36.90	37.31	37.72	38 13	38 54	
42	0.210	34.02	34 44	34.86	35.28	35.70	36.12	36.54	36.96	37.38	37.80	38.22	38.64	39.06	39 48	
43	0.215	34.83	35.26	35.69	36.12	36.55	36.98	37.41	37.84	38.27	38.70	39.13	39.56	39.99	40 42	
44	0.220	35.64	36 08	36.52	36.96	37.40	37.84	38.28	38.72	39.16	39.60	40.04	40.48	40.92	41.36	
45	0.225	36.45	36.90	37.35	37.80	38.25	38.70	39.15	39.60	40.05	40.50	40.95	41.40	41.85	42.30	
46	0.230	37.26	37 72	38.18	38.64	39.10	39.56	40.02	40.48	40 94	41.40	41.86	42.32	42 78	43.24	
47	0.235	38.07	38.54	39.01	39.48	39.95	40.42	40.89	41.36	41.83	42.30	42 77	43.24	43.71	44.18	
48	0.240	38.88	39.36	39.84	40.32	40.80	41.28	41.76	42.24	42 72	43 20	43.68	44.16	44.64	45.12	
49	0.245	39.69	40.18	40.67	41.16	41.65	42.14	42.63	43.12	43.61	44.10	44.59	45.08	45.57	46.06	
50	0.250	40.50	41.00	41.50	42 00	42.50	43.00	43.50	44.00	44.50	45.00	45 50	46 00	46.50	47 00	
51	0.255	41.31	41.82	42.33	42.84	43.35	43.86	44.37	44.88	45.39	45.90	46.41	46.92	47.43	47.94	
52	0.260	42.12	42.64	43.16	43.68	44.20	44.72	45.24	45.76	46.28	46.80	47.32	47.84	48 36	48.88	
53	0.265	42.93	43.46	43.99	44.52	45.05	45.58	46.11	46.64	47.17	47.70	48.23	48.76	49.29	49 82	
54	0.270	43.74	44.28	44.82	45.36	45.90	46.44	46.98	47.52	48.06	48.60	49.14	49.68	50.22	50.76	
55	0.275	44.55	45.10	45.65	46.20	46.75	47 30	47.85	48.40	48.95	49.50	50 05	50 60	51 15	51 70	
56	0.280	45.36	45.92	46.48	47.04	47.60	48 16	48.72	49.28	49.84	50.40	50.96	51.52	52 08	52 64	
57	0.285	46.17	46.74	47.31	47.88	48 45	49.02	49.59	50.16	50.73	51.30	51.87	52.44	53.01	53 58	
58	0.290	46.98	47.56	48.14	48.72	49.30	49.88	50.56	51.04	51.62	52.20	52.78	53 36	53 94	54.52	
59	0.295	47.79	48.38	48.97	49.56	50.15	50.74	51.33	51.92	52.51	53.10	53.69	54.28	54 87	55 46	
60	0.300	48.60	49.20	49.80	50.40	51.00	51.60	52.20	52.80	53.40	54.00	54.60	55.20	55 80	56.40	

WAGE TABLE.—(*Continued*)

Hours	Rate per hour, cents											
	½	95	96	97	98	99	1.00	1.01	1.02	1.03	1.04	1.05
¼	.....	0.238	0.240	0.243	0.245	0.248	0.250	0.253	0.255	0 258	0.260	0.263
½	.....	0.475	0.480	0.485	0.490	0 495	0.500	0.505	0 510	0.515	0.520	0.525
¾	0.004	0.713	0.720	0.728	0.735	0.743	0.750	0.758	0.765	0.773	0.780	0 788
2	0.010	1.90	1.92	1.94	1.96	1.98	2.00	2.02	2.04	2.06	2.08	2.10
3	0.015	2.85	2.88	2.91	2.94	2.97	3.00	3.03	3.06	3.09	3.12	3.15
4	0.020	3.80	3.84	3.88	3.92	3.96	4.00	4.04	4.08	4.12	4.16	4.20
5	0.025	4.75	4.80	4.85	4.90	4.95	5.00	5.05	5.10	5.15	5.20	5.25
6	0.030	5.70	5.76	5.82	5.88	5.94	6.00	6.06	6.12	6.18	6.24	6.30
7	0.035	6.65	6.72	6.79	6.86	6.93	7.00	7.07	7.14	7.21	7.28	7.35
8	0.040	7.60	7.68	7.76	7.84	7.92	8.00	8.08	8.16	8.24	8.32	8.40
9	0.045	8.55	8.64	8.73	8.82	8.91	9.00	9.09	9.18	9.27	9.36	9.45
10	0.050	9.50	9.60	9.70	9.80	9.90	10.00	10.10	10.20	10.30	10.40	10.50
11	0.055	10.45	10.56	10.67	10.78	10.89	11.00	11.11	11.22	11.33	11.44	11.55
12	0.060	11.40	11.52	11.64	11.76	11.88	12.00	12 12	12 24	12 36	12 48	12.60
13	0.065	12.35	12.48	12.61	12.74	12.87	13.00	13.13	13.26	13.39	13.52	13.65
14	0.070	13.30	13.44	13.58	13.72	13.86	14.00	14.14	14.28	14.42	14.56	14.70
15	0.075	14.25	14.40	14.55	14.70	14.85	15.00	15.15	15.30	15.45	15.60	15.75
16	0.080	15.20	15.36	15.52	15.68	15.84	16.00	16.16	16 32	16 48	16 64	16 80
17	0.085	16.15	16.32	16.49	16.66	16.83	17.00	17.17	17.34	17.51	17.68	17.85
18	0.090	17.10	17.28	17.46	17.64	17.82	18.00	18.18	18.36	18.54	18.72	18.90
19	0.095	18.05	18.24	18.43	18.62	18.81	19.00	19.19	19.38	19 57	19.76	19.95
20	0.100	19.00	19.20	19.40	19.60	19.80	20.00	20.20	20.40	20.60	20.80	21.00
21	0.105	19.95	20.16	20.37	20.58	20.79	21.00	21.21	21.42	21.63	21.84	22.05
22	0.110	20.90	21.12	21.34	21.56	21.78	22.00	22.22	22.44	22.66	22.88	23.10
23	0.115	21.85	22.08	22.31	22.54	22.77	23.00	23.23	23.46	23 69	23 92	24 15
24	0.120	22.80	23.04	23 28	23.52	23 76	24.00	24.24	24.48	24 72	24 96	25 20
25	0.125	23.75	24.00	24.25	24.50	24.75	25.00	25.25	25.50	25.75	26.00	26.25
26	0.130	24.70	24.96	25.22	25.48	25.74	26.00	26.26	26.52	26.78	27.04	27.30
27	0.135	25.65	25.92	26.19	26.46	26.73	27.00	27.27	27.54	27.81	28.08	28.35
28	0.140	26.60	26.88	27.16	27.44	27.72	28.00	28.28	28.56	28.84	29.12	29.40
29	0.145	27.55	27.84	28.13	28.42	28.71	29.00	29.29	29.58	29.87	30.16	30.45
30	0.150	28.50	28.80	29.10	29.40	29.70	30.00	30.30	30.60	30.90	31.20	31.50
31	0.155	29.45	29.76	30.07	30.38	30.69	31.00	31.31	31.62	31.93	32.24	32.55
32	0.160	30.40	30 72	31.04	31.36	31 68	32.00	32.32	32.64	32.96	33.28	33.60
33	0.165	31.35	31.68	32.01	32.34	32.67	33.00	33.33	33.66	33.99	34.32	34.65
34	0.170	32.30	32.64	32.98	33.32	33.66	34.00	34.34	34.68	35 02	35 36	35.70
35	0.175	33.25	33.60	33.95	34.30	34.65	35.00	35.35	35.70	36.05	36.40	36.75
36	0.180	34.20	34.56	34.92	35.28	35.64	36.00	36.36	36.72	37.08	37.44	37.80
37	0.185	35.15	35.52	35.89	36.26	36.63	37.00	37.37	37.74	38.11	38.48	38.85
38	0.190	36.10	36.48	36.86	37.24	37.62	38.00	38.38	38.76	39.14	39.52	39.90
39	0.195	37.05	37.44	37.83	38.22	38.61	39.00	39.39	39.78	40.17	40.56	40.95
40	0.200	38.00	38 40	38.80	39 20	39 60	40 00	40.40	40 80	41 20	41 60	42.00
41	0.205	38.95	39 36	39.77	40.18	40.59	41.00	41.41	41.82	42.23	42 64	43.05
42	0.210	39.90	40.32	40.74	41.16	41.58	42.00	42.42	42.84	43.26	43.68	44.10
43	0.215	40.85	41.28	41.71	42.14	42.57	43.00	43.43	43.86	44.29	44.72	45.15
44	0.220	41 80	42 24	42 68	43.12	43.56	44.00	44.44	14.88	45 32	45.76	46.20
45	0.225	42.75	43.20	43.65	44.10	44.55	45.00	45.45	45.90	46.35	46.80	47.25
46	0.230	43.70	44 16	44.62	45 08	45 54	46 00	46.46	46.92	47.38	47.84	48.30
47	0.235	44.65	45.12	45.59	46.06	46.53	47.00	47.47	47.94	48.41	48.88	49.35
48	0.240	45.60	46 08	46.56	47.04	47.52	48.00	48.48	48.96	49.44	49.92	50.40
49	0.245	46.55	47.04	47.53	48.02	48.51	49.00	49.49	49.98	50.47	50.96	51.45
50	0.250	47.50	48.00	48.50	49.00	49.50	50.00	50.50	51.00	51.50	52.00	52.50
51	0.255	48 45	48 96	49.47	49.98	50 49	51.00	51.51	52.02	52.53	53 04	53.55
52	0.260	49 40	49.92	50.44	50.96	51.48	52.00	52.52	53.04	53.56	54.08	54.60
53	0.265	50.35	50.88	51.41	51.94	52.47	53.00	53.53	54.06	54.59	55.12	55.65
54	0.270	51.30	51.84	52.38	52.92	53.46	54.00	54.54	55.08	55.62	56.16	56.70
55	0.275	52.25	52 80	53.35	53.90	54.45	55.00	55.55	56.10	56.65	57.20	57.75
56	0 280	53 20	53.76	54.32	54.88	55 44	56 00	56.56	57.12	57.68	58 24	58.80
57	0.285	54.15	54.72	55.29	55.86	56.43	57 00	57.57	58.14	58.71	59.28	59.85
58	0.290	55.10	55.68	56.26	56.84	57 42	58.00	58.58	59.16	59.74	60.32	60.90
59	0.295	56 05	56.64	57.23	57.82	58.41	59.00	59.59	60.18	60.77	61.36	61.95
60	0.300	57.00	57.60	58.20	58.80	59.40	60.00	60.60	61.20	61.80	62.40	63.00

WAGE TABLE.—(*Continued*)

Hours	Rate per hour									
	$1.06	$1.07	$1.08	$1.09	$1.10	$1.11	$1.12	$1.13	$1.14	$1.15
¼	0.265	0.268	0.270	0.273	0.275	0.278	0.280	0.283	0.285	0.288
½	0.530	0.535	0.540	0.545	0.550	0.555	0.560	0.565	0.570	0.575
¾	0.795	0.803	0.810	0.818	0.825	0.833	0.840	0.848	0.855	0.863
2	2.12	2.14	2.16	2.18	2.20	2.22	2.24	2.26	2.28	2.30
3	3.18	3.21	3.24	3.27	3.30	3.33	3.36	3.39	3.42	3.45
4	4.24	4.28	4.32	4.36	4.40	4.44	4.48	4.52	4.56	4.60
5	5.30	5.35	5.40	5.45	5.50	5.55	5.60	5.65	5.70	5.75
6	6.36	6.42	6.48	6.54	6.60	6.66	6.72	6.78	6.84	6.90
7	7.42	7.49	7.56	7.63	7.70	7.77	7.84	7.91	7.98	8.05
8	8.48	8.56	8.64	8.72	8.80	8.88	8.96	9.04	9.12	9.20
9	9.54	9.63	9.72	9.81	9.90	9.99	10.08	10.17	10.26	10.35
10	10.60	10.70	10 80	10.90	11.00	11.10	11.20	11.30	11.40	11.50
11	11.66	11.77	11.88	11.99	12.10	12.21	12.32	12.43	12.54	12.65
12	12.72	12.84	12.96	13.08	13.20	13.32	13.44	13.56	13.68	13.80
13	13.78	13.91	14.04	14.17	14.30	14.43	14.56	14.69	14.82	14.95
14	14.84	14.98	15.12	15.26	15.40	15.54	15.68	15.82	15.96	16.10
15	15.90	16.05	16.20	16.35	16.50	16.65	16.80	16.95	17.10	17.25
16	16.96	17.12	17.28	17.44	17.60	17.76	17.92	18.08	18.24	18.40
17	18.02	18.19	18.36	18.53	18.70	18.87	19.04	19.21	19.38	19.55
18	19.08	19.26	19.44	19.62	19.80	19.98	20.16	20.34	20.52	20.70
19	20.14	20.33	20.52	20.71	20.90	21.09	21.28	21.47	21.66	21.85
20	21.20	21.40	21.60	21.80	22.00	22.20	22.40	22.60	22.80	23.00
21	22.26	22.47	22.68	22.89	23.10	23.31	23.52	23.73	23.94	24.15
22	23.32	23.54	23.76	23.98	24.20	24.42	24.64	24.86	25.08	25.30
23	24.38	24.61	24.84	25.07	25.30	25.53	25.76	25.99	26.22	26.45
24	25.44	25.68	25.92	26.16	26.40	26.64	26.88	27.12	27.36	27.60
25	26.50	26.75	27.00	27.25	27.50	27.75	28.00	28.25	28.50	28.75
26	27.56	27.82	28.08	28.34	28.60	28.86	29.12	29.38	29.64	29.90
27	28.62	28.98	29.16	29.43	29.70	29.97	30.24	30.51	30.78	31.05
28	29.68	29.96	30.24	30.52	30.80	31.08	31.36	31.64	31.92	32.20
29	30.74	31.03	31.32	31.61	31.90	32.19	32.48	32.77	33.06	33.35
30	31.80	32.10	32.40	32.70	33.00	33.30	33.36	33.39	34.20	34.50
31	32.86	33.17	33.48	33.79	34.10	34.41	34.72	35.03	35.34	35.65
32	33.92	34.24	34.56	34.88	35.20	35.52	35.84	36.16	36.48	36.80
33	34.98	35.31	35.64	35.97	36.30	36.63	36.96	37.29	37.62	37.95
34	36.04	36.38	36.72	37.06	37.40	37.74	38.08	38.42	38.76	39.10
35	37.10	37.45	37.80	38.15	38.50	38.85	39.20	39.55	39.90	40.25
36	38.16	38.52	38.88	39.24	39.60	39.96	40.32	40.68	41.04	41.40
37	39.22	39.59	39.96	40.33	40.70	41.07	41.44	41.81	42.18	42.55
38	40.28	40.66	41.04	41.42	41.80	42.18	42.56	42.94	43.32	43.70
39	41.34	41.73	42.12	42.51	42.90	43.29	43.68	44.07	44.46	44.85
40	42.40	42.80	43.20	43.60	44.00	44.40	44.80	45.20	45.60	46.00
41	43.46	43.87	44.28	44.69	45.10	45.51	45.92	46.33	46.74	47.15
42	44.52	44.94	45.36	45.78	46.20	46.62	47.04	47.46	47.88	48.30
43	45.58	46.01	46.44	46.87	47.30	47.73	48.16	48.59	49.02	49.45
44	46.64	47.08	47.52	47.96	48.40	48.84	49.28	49.72	50.16	50.60
45	47.70	48.15	48.60	49.05	49.50	49.95	50.40	50.85	51.30	51.75
46	48.76	49.22	49.68	50.14	50.60	51.06	51.52	51.98	52.44	52.90
47	49.82	50.29	50.76	51.23	51.70	52.17	52.64	53.11	53.58	54.05
48	50.88	51.36	51.84	52.32	52.80	53.28	53.76	54.24	54.72	55.20
49	51.94	52.43	52.92	53.41	53.90	54.39	54.88	55.37	55.86	56.35
50	53.00	53.50	54.00	54.50	55.00	55.50	56.00	56.50	57.00	57.50
51	54.06	54.57	55.08	55.59	56.10	56.61	57.12	57.63	58.14	58.65
52	55.12	55.64	56.16	56.68	57.20	67.72	58.24	58.76	59.28	59.80
53	56.18	56.71	57.24	57.77	58.30	58.83	59.36	59.89	60.42	60.95
54	57.24	57.78	58.32	58.86	59.40	59.94	60.48	61.02	61.56	62.10
55	58.30	58.85	59.40	59.95	60.50	61.05	61.60	62.15	62.70	63.25
56	59.36	59.92	60.48	61.04	61.60	62.16	62.72	63.28	63.84	64.40
57	60.42	60.99	61.56	62.13	62.70	63.27	63.84	64.41	64.98	65 55
58	61.48	62.06	62.64	63.22	63.80	64.38	64.96	65.54	66.12	66.70
59	62.54	63.13	63.72	64.31	64.90	65.49	66.08	66.67	67.26	67.85
60	63.60	64.20	64.80	65.40	66.00	66.60	67.20	67.80	68.40	69.00

WAGE TABLE.—(*Continued*)

Hours	Rate per hour									
	$1.16	$1.17	$1.18	$1.19	$1.20	$1.21	$1.22	$1.23	$1.24	$1.25
¼	0.290	0.293	0.295	0.298	0.300	0.303	0.305	0.308	0.310	0.313
½	0.580	0.585	0.590	0.595	0.600	0.605	0.610	0.615	0.620	0.625
¾	0.870	0.878	0.885	0.893	0.900	0.908	0.915	0.923	0.930	0.938
2	2.32	2.34	2.36	2.38	2.40	2.42	2.44	2.46	2.48	2.50
3	3.48	3.51	3.54	3.57	3.60	3.63	3.66	3.69	3.72	3.75
4	4.64	4.68	4.72	4.76	4.80	4.84	4.88	4.92	4.96	5.00
5	5.80	5.85	5.90	5.95	6.00	6.05	6.10	6.15	6.20	6.25
6	6.96	7.02	7.08	7.14	7.20	7.26	7.32	7.38	7.44	7.50
7	8.12	8.19	8.26	8.33	8.40	8.47	8.54	8.61	8.68	8.75
8	9.28	9.36	9.44	9.52	9.60	9.68	9.76	9.84	9.92	10.00
9	10.44	10.53	10.62	10.71	10.80	10.89	10.98	11.07	11.16	11.25
10	11.60	11.70	11.80	11.90	12.00	12.10	12.20	12.30	12.40	12.50
11	12.76	12.87	12.98	13.09	13.20	13.31	13.42	13.53	13.64	13.75
12	13.92	14.04	14.16	14.28	14.40	14.52	14.64	14.76	14.88	15.00
13	15.08	15.21	15.34	15.47	15.60	15.73	15.86	15.99	16.12	16.25
14	16.24	16.38	16.52	16.66	16.80	16.94	17.08	17.22	17.36	17.50
15	17.40	17.55	17.70	17.85	18.00	18.15	18.30	18.45	18.60	18.75
16	18.56	18.72	18.88	19.04	19.20	19.36	19.52	19.68	19.84	20.00
17	19.72	19.89	20.06	20.23	20.40	20.57	20.74	20.91	21.08	21.25
18	20.88	21.06	21.24	21.42	21.60	21.78	21.96	22.14	22.32	22.50
19	22.04	22.23	22.42	22.61	22.80	22.99	23.18	23.37	23.56	23.75
20	23.20	23.40	23.60	23.80	24.00	24.20	24.40	24.60	24.80	25.00
21	24.36	24.57	24.78	24.99	25.20	25.41	25.62	25.83	26.04	26.25
22	25.52	25.74	25.96	26.18	26.40	26.62	26.84	27.06	27.28	27.50
23	26.68	26.91	27.14	27.37	27.60	27.83	28.06	28.29	28.52	28.75
24	27.84	28.08	28.32	28.56	28.80	29.04	29.28	29.52	29.76	30.00
25	29.00	29.25	29.50	29.75	30.00	30.25	30.50	30.75	31.00	31.25
26	30.16	30.42	30.68	30.94	31.20	31.46	31.72	31.98	32.24	32.50
27	31.32	31.59	31.86	32.13	32.40	32.67	32.94	33.21	33.48	33.75
28	32.48	32.76	33.04	33.32	33.60	33.88	34.16	34.44	34.72	35.00
29	33.64	33.93	34.22	34.51	34.80	35.09	35.38	35.67	35.96	36.25
30	34.80	35.10	35.40	35.70	36.00	36.30	36.60	36.90	37.20	37.50
31	35.96	36.27	36.58	36.89	37.20	37.51	37.82	38.13	38.44	38.75
32	37.12	37.44	37.76	38.08	38.40	38.72	39.04	39.36	39.68	40.00
33	38.28	38.61	38.94	39.27	39.60	39.93	40.26	40.59	40.92	41.25
34	39.44	39.78	40.12	40.46	40.80	41.14	41.48	41.82	42.16	42.50
35	40.60	40.95	41.30	41.65	42.00	42.35	42.70	43.05	43.40	43.75
36	41.76	42.12	42.48	42.84	43.20	43.56	43.92	44.28	44.64	45.00
37	42.92	43.29	43.66	44.03	44.40	44.77	45.14	45.51	45.88	46.25
38	44.08	44.46	44.84	45.22	45.60	45.98	46.36	46.74	47.12	47.50
39	45.24	45.63	46.02	46.41	46.80	47.19	47.58	47.97	48.36	48.75
40	46.40	46.80	47.20	47.60	48.00	48.40	48.80	49.20	49.60	50.00
41	47.56	47.97	48.38	48.79	49.20	49.61	50.02	50.43	50.84	51.25
42	48.72	49.14	49.56	49.98	50.40	50.82	51.24	51.66	52.08	52.50
43	49.88	50.31	50.74	51.17	51.60	52.03	52.46	52.89	53.32	53.75
44	51.04	51.48	51.92	52.36	52.80	53.24	53.68	54.12	54.56	55.00
45	52.20	52.65	53.10	53.55	54.00	54.45	54.90	55.35	55.80	56.25
46	53.36	53.82	54.28	54.74	55.20	55.66	56.12	56.58	57.04	57.50
47	54.52	54.99	55.46	55.93	56.40	56.87	57.34	57.81	58.28	58.75
48	55.68	56.16	56.64	57.12	57.60	58.08	58.56	59.04	59.52	60.00
49	56.84	57.33	57.82	58.31	58.80	59.29	59.78	60.27	60.76	61.25
50	58.00	58.50	59.00	59.50	60.00	60.50	61.00	61.50	62.00	62.50
51	59.16	59.67	60.18	60.69	61.20	61.71	62.22	62.73	63.23	63.75
52	60.32	60.84	61.36	61.88	62.40	62.92	63.44	63.96	64.48	65.00
53	61.48	62.01	62.54	63.07	63.60	64.13	64.66	65.19	65.72	66.25
54	62.64	63.18	63.72	64.26	64.80	65.34	65.88	66.42	66.96	67.50
55	63.80	64.35	64.90	65.45	66.00	66.55	67.10	67.65	68.20	68.75
56	64.95	65.52	66.08	66.64	67.20	67.76	68.32	68.88	69.44	70.00
57	66.12	66.69	67.26	67.83	68.40	68.97	69.54	70.11	70.68	71.25
58	67.28	67.86	68.44	69.02	69.60	70.18	70.76	71.34	71.92	72.50
59	68.44	69.03	69.62	70.21	70.80	71.39	71.98	72.57	73.16	73.75
60	69.60	70.20	70.80	71.40	72.00	72.60	73.20	73.80	74.40	75.00

TIME TO UNLOAD BUILDING MATERIALS FROM A CAR

Material	Unit	Time required per unit
Sand	C.Y.	0.60
Gravel	C.Y.	0.65
Broken stone	C.Y.	0.75
Portland cement in bags	Bbl.	0.20
Lumber	M	3.00
Shingles	M	0.25
Slate	M	1.00
Brick common	M	1.50
Brick face	M	2.50

The time given is the average as reported by some fifteen general contractors. The time given for sand, broken stone and gravel is for shoveling over the side to a wagon or pile, while for lumber, brick etc., it includes transporting not more than 50 ft. and piling.

VOIDS IN SAND

To obtain the percentage of voids in sand, a measured volume of well-shaken dry sand is poured into a measured volume of water. The volume of water displaced by the sand is subtracted from the volume of the sand. The difference will be the volume of the voids in the sand, which, divided by the volume of the sand, will give the proportion of voids.

The percentage of voids in sand can be ascertained by weight, as most of the stone from which sand is derived weighs approximately 165 lb. per cubic foot. Therefore, the weight of a cubic foot of dry sand should be deducted from 165 lb. and the difference divided by 165. The result multiplied by 100 will give the percentage of voids: $P = 100\left(\frac{165 - W}{165}\right)$ in which P is the percentage and W the weight of the sand.

EQUIVALENT DISCOUNT

Rule.—To reduce a discount series to an equivalent single discount, subtract each rate of discount from 1, and multiply the remainders together. Subtract the product from 1 and the remainder will be the single discount.

Example.—What single discount on the gross price is equivalent to a discount series of 60 per cent, 20 per cent and 10 per cent?

Solution.—1 − 0.60 = 0.40; 1 − 0.20 = 0.80; 1 − 0.10 = 0.90; 0.40 by 0.80 by 0.90 = 0.288; 1 − 0.288 = 0.712, or 71 per cent.

Braided Sash Cords

Braided sash cord is put up in hanks of 100 ft. each, two connected, one dozen hanks (1,200 ft.) in a package; 6 doz. Nos. 6 to 9 inclusive and 4 doz. Nos. 10 and 12 in a bale; or in coils of any length, as ordered.

Number	Diameter, inches	Weight per dozen hanks pounds	Length per pound, feet	Suitable for weights, pounds	Number	Diameter, inches	Weight per dozen hanks, pounds	Length per pound, feet	Suitable for weights, pounds
6	3/16	17	70	Less than 10	9	9/32	32	37	25 to 35
7	7/32	22	55	10 to 15	10	5/16	40	30	35 to 45
8	1/4	26	46	15 to 25	12	3/8	58	21	45 to 60

MANILA ROPE

Manila, sisal and jute rope weigh about alike. Tarred hemp cordage will weigh about one-fourth more. The relative strength of manila to sisal is about as 7 is to 5.

The average price per pound for 3/4-in. rope and larger, in 1,200-ft. coils is 18 cts. per pound. For rope smaller than 3/4-in., the price is 1/2 to 2 cts. extra, while for quantities of less than 600 ft., there is an extra charge of 1 ct. per pound.

Approximate Weight and Strength of Manila Rope

Diameter, inches	Circumference, inches	Number of feet in 1 lb.	Full coils		Strength of new manila rope, pounds	Diameter, inches	Circumference, inches	Number of feet in 1 lb.	Full coils		Strength of new manila rope, pounds
			Length, feet	Weight, pounds					Length, feet	Weight, pounds	
3/16	6-thread fine	75	2,280	30	500	1 1/4	3 3/4	2 1/6	1,200	510	12,500
1/4	6-thread fine	55	2,600	50	620	1 3/8	4 1/4	1 9/10	1,200	660	14,000
5/16	9-thread fine	41	1,870	55	1,000	1 1/2	4 1/2	1 1/2	1,200	775	17,000
3/8	12-thread fine	26	1,690	65	1,275	1 5/8	5	1 1/6	1,200	950	20,000
7/16	1 1/4	19	1,400	75	1,875	1 3/4	5 1/2	1	1,200	1,150	25,000
1/2	1 1/2	13 1/2	1,200	92	2,400	2	6	10 in.	1,200	1,376	30,000
9/16	1 3/4	10	1,200	130	3,300	2 1/8	6 1/2	8 3/5 in.	1,200	1,600	33,000
5/8	2	7 1/2	1,200	160	4,000	2 1/4	7	7 3/5 in.	1,200	1,850	37,000
3/4	2 1/4	6	1,200	200	4,700	2 1/2	7 1/2	6 1/2 in.	1,200	2,200	43,000
13/16	2 1/2	5	1,200	250	5,600	2 5/8	8	5 3/8 in.	1,200	2,550	50,000
7/8	2 3/4	4	1,200	290	6,500	2 7/8	8 1/2	5 in.	1,200	2,850	56,000
1	3	3 1/3	1,200	350	7,500	3	9	4 1/2 in.	1,200	3,150	62,000
1 1/16	3 1/4	2 7/8	1,200	400	8,900	3 1/8	9 1/2	4 in.	1,200	3,470	68,000
1 1/8	3 1/2	2 1/2	1,200	450	10,500	3 3/8	10	3 5/8 in.	1,200	3,850	75,000

Standard Wire Hoisting Rope

6 Strands of 19 wires each and a hemp center

Trade numbers	Diameters, inches	Ap. circumference, Inches	Weight per foot, pounds	Ap. breaking strain in tons of 2,000 lb.	Allowable work strain in tons of 2,000 lb.	Min. sizes of drum or sheave, feet	Prices per foot
			Plough steel				
00	2¾	8⅝	11.95	275.00	55.00	11	3.00
0	2½	7⅞	9.85	229.00	46.00	10	2.50
1	2¼	7⅛	8.00	186.00	37.00	9	2.00
2	2	6¼	6.30	140.00	28.00	8	1.58
2½	1⅞	5¾	5.55	127.00	25.00	8	1.46
3	1¾	5½	4.85	112.00	22.00	7	1.30
4	1⅝	5	4.15	94.00	19.00	6½	1.08
5	1½	4¾	3.55	82.00	16.00	6	0.93
5½	1⅜	4¼	3.00	72.00	14.00	5½	0.79
6	1¼	4	2.45	58.00	12.00	5	0.65
7	1⅛	3½	2.00	47.00	9.40	4½	0.54
8	1	3	1.58	38.00	7.60	4	0.43
9	⅞	2¾	1.20	29.00	5.80	3½	0.34
10	¾	2¼	0.89	23.00	4.60	3	0.26
10¼	⅝	2	0.62	15.50	3.10	2½	0.19
10½	9/16	1¾	0.50	12.30	2.40	2¼	0.16
10¾	½	1½	0.39	10.00	2.00	2	0.14
10*a*	7/16	1¼	0.30	8.00	1.60	1¾	0.13
10*b*	⅜	1⅛	0.22	5.75	1.15	1½	0.12½
10*c*	5/16	1	0.15	3.80	0.76	1¼	0.12¼
10*d*	¼	¾	0.10	2.65	0.53	1	0.12

Note.—When the plough steel rope is galvanized, add 10 per cent to the list price per foot and apply galvanized discount. When made with wire center, add 10 per cent to list price per foot. Discount 35 per cent for New York and territory east of Missouri River.

Chain—Close and Stud Link Cable Chain

Size, inches	Outside length, inches		Outside width, inches		Average weight per fathom, pounds		Proof test, pounds	
	Close link	Stud link	Close link	Stud link	Close link	Stud link	Close link	Stud link
¾	...	4⅜	...	2¾	...	33	.....	20,250
13/16	...	4¾	...	3	...	38	.....	24,000
⅞	...	5	...	3¼	...	49	.....	27,500
15/16	...	5⅜	...	3½	...	55	.....	31,500
1	4⅝	5⅞	3½	3¾	62	61	24,000	36,000
1 1/16	5	6¼	3⅝	3⅞	71	69	25,000	40,600
1 ⅛	5⅜	6½	3⅞	4⅛	76	74	32,500	45,600
1 3/16	5½	6¾	4⅛	4¼	82	81	33,800	51,000
1 ¼	5¾	7⅛	4¼	4½	91	90	36,500	56,200
1 5/16	6	7⅜	4½	4⅝	99	97	41,250	62,000
1 ⅜	6¼	7¼	4¾	4⅞	113	110	45,250	68,000
1 7/16	6⅝	8⅛	5	5⅛	118	113	49,500	74,200
1 ½	6⅞	8½	5¼	5⅜	130	127	54,000	81,000
1 9/16	7¼	8⅞	5½	5⅝	138	143	58,500	88,000
1 ⅝	7½	9¼	5¾	5⅞	152	150	63,250	95,000
1 11/16	...	9⅝	...	6	...	157	.....	102,400
1 ¾	...	10	...	6¼	...	173	.....	110,200
1 ⅞	...	10½	...	6¾	...	203	.....	126,600
1 15/16	...	10¾	...	7	...	215	.....	135,000
2	...	11⅛	...	7¼	...	233	.....	144,000
2 1/16	...	11½	...	7½	...	254	.....	153,000
2 ⅛	...	12	...	7¾	...	276	.....	162,250
2 3/16	...	12½	...	8	...	290	.....	172,250
2 ¼	...	13	...	8¼	...	300	.....	182,000

Above are the U. S. standard dimensions and are the same as adopted by the leading manufacturers of ship windlasses.

The standard sizes of Standard Close Link Chain is 1 to 1⅝ in. Standard sizes of Stud Link, ¾ to 2¼ in. Larger sizes made to order.

SAFE LOAD FORMULA FOR I-BEAMS

The following formula will give a very close approximation for a safe load for a steel beam. It can be used when no tables are available provided the weight of the section is known.

$$\frac{D \times W}{2S} = L$$

in which D is the depth of the beam in inches, W the weight of section per linear foot in pounds, S the span in feet, and L the safe load in tons.

Example: What is the safe load on a 20-in., 65-lb. I-beam for a 30-ft. span Also for a 15-in., 42-lb. I-beam for a 20-ft. span?

$$\frac{20 \times 65}{2 \times 30} = 21.70 \text{ tons—Carnegie gives } 20.80 \text{ tons.}$$

$$\frac{15 \times 42}{2 \times 20} = 15.75 \text{ tons—Carnegie gives } 15.70 \text{ tons.}$$

Strength of Materials

Stresses in pounds per square inch

Building materials	Ultimate average stresses			Modulus of elasticity	Safe working stresses		
	Compress.	Tension	Bending		Compress.	Bearing	Shearin
Stone							
Granite, gneiss, bluestone	12,000	1,200	1,600	7,000,000	1,200	1,200	200
Limestone, marble	8,000	800	1,500	7,000,000	800	800	150
Sandstone	5,000	150	1,200	3,000,000	500	500	150
Slate	10,000	3,000	5,000	14,000,000	1,000	1,000	175
Masonry							
Granite	.....	.....	.....	.....	420	600	
Limestone, bluestone	.....	.....	.....	.....	350	500	
Sandstone	.....	.....	.....	.....	280	400	
Rubble	.....	.....	.....	.....	140	250	
Rubble coursed	.....	.....	.....	.....	170	250	
Brick, medium burned	10,000	.....	.....	.....	170	300	
Brick, hard burned	15,000	.....	.....	.....	210	300	
Brick pressed, paving brick	6,000						
Terra cotta	5,000						
Cement, Portland							
Neat, 28 days	7,040	740					
Neat, 90 days	7,350	740					
1: 3 sand, 28 days	1,290	320					
1: 3 sand, 90 days	1,490	340					
Concrete, P. C.							
1:1:2 Granite, trap rock	3,300						
1:1:2 Furnace slag	3,000						
1:1:2 Lime and sandstone, hard	3,000						
1:1:2 Lime and sandstone, soft	2,200						
1:1:2 Cinders	800						
1:1½:3 Granite, trap rock	2,800						
1:1½:3 Furnace slag	2,500						
1:1½:3 Lime and sandstone, hard	2,500						
1:1½:3 Lime and sandstone, soft	1,800						
1:1½:3 Cinders	700						
1:2:4 Granite, trap rock	2,200						
1:2:4 Furnace slag	2,000						
1:2:4 Lime and sandstone, hard	2,000						
1:2:4 Lime and sandstone, soft	1,500						
1:2:4 Cinders	600						
1:2½:5 Granite, trap rock	1,800						
1:2½:5 Furnace slag	1,600						
1:2½:5 Lime and sandstone, hard	1,600						
1:2½:5 Lime and sandstone, soft	1,200						
1:2½:5 Cinders	500						
1:3:6 Granite, trap rock	1,400						
1:3:6 Furnace slag	1,300						
1:3:6 Lime and sandstone, hard	1,300						
1:3:6 Lime and sandstone, soft	1,000						
1:3:6 Cinders	400						
Miscellaneous							
Glass, common	30,000						
Plaster	700						

Reinforced concrete

Modulus of elasticity:
- 3,000,000 for ult. compression over . . 2,900
- 2,500,000 for ult. compression up to . . . 2,900
- 2,000,000 for ult. compression up to . . . 2,200
- 750,000 for ult. compression under . . . 800

Safe working stresses in percent of ultimate compression

Compression:
- Plain concrete piers, length 4 dia 22.5
- Reinforced columns, length 12 dia 22.5
- Reinforced beams 32.5

Bearing . . . . . Surface twice the loaded area 35.0

Shear and diag. tension:
- Horizontal bars, no web reinforcement 2.0
- Horizontal bars, vertical stirrups 4.5
- Bent bars and vertical stirrups 5.0
- Same, securely attached 6.0

Bond stress:
- Drawn wire 2.0
- Plain reinforcing bars 4.0
- Deformed bars, best type 5.0

For complete data see Transactions of the American Society of Civil Engineers, Vol. LXXXI-No. 1398, Dec., 1917.

3,000						
70	3,000	8,000,000				

(*Carnegie*).

CONTENTS OF STORAGE WAREHOUSES

Material	Weights per cubic foot of space, pounds	Height of pile, feet	Weights per square foot of floor, pounds	Recommended live loads, pounds per square foot
Building materials:				
Cement, natural	59	6	354	300 to 400
Cement, Portland	73	6	438	
Lime and plaster	53	5	265	
Hardware, etc.:				
Door checks	45	...	...	300 to 400
Hinges	54	...	...	
Locks, in cases packed	31	...	...	
Sash fasteners	48	...	...	
Screws	101	...	...	
Sheet tin, in boxes	278	2	556	
Wire cables, on reels	...	...	425	
Wire, insulated copper, in coils	63	5	315	
Wire, galvanized iron, in coils	74	4½	333	
Wire, magnet, on spools	75	6	450	
Drugs, paints, oils, etc.:				
Alum, pearl, in barrels	33	6	198	200 to 300
Bleaching powder, in hogsheads	31	3½	102	
Blue vitriol, in barrels	45	5	226	
Glycerine, in cases	52	6	312	
Linseed oil, in iron drums	45	4	180	
Linseed oil, in barrels	36	6	216	
Logwood extract, in boxes	70	5	350	
Rosin, in barrels	48	6	288	
Shellac, gum	38	6	228	
Soda ash, in hogsheads	62	2¾	167	
Soda, caustic, in iron drums	88	3⅛	294	
Soda, silicate, in barrels	53	6	318	
Sulphuric acid	60	1⅜	100	
White lead paste, in cans	174	3½	610	
White lead, dry	86	4¾	408	
Red lead and litharge, dry	132	3¾	495	
Miscellaneous:				
Glass and chinaware, in crates	40	8	320	300
Hides and leather, in bales	20	8	160	
Hides, buffalo, in bundles	37	8	296	
Paper, newspaper and strawboards	35	6	210	
Paper, writing and calendared	60	6	360	
Rope, in coils	32	6	192	

CONTENTS OF STORAGE WAREHOUSES.—(*Continued*)

Material	Weights per cubic foot of space, pounds	Height of pile, feet	Weights per square foot of floor, pounds	Recommended live loads, pounds per square foot
Groceries, wines, liquors, etc.:				
Beans, in bags	40	8	320	
Canned goods, in cases	58	6	348	
Coffee, roasted, in bags	33	8	264	
Coffee, green, in bags	39	8	312	
Dates, in cases	55	6	330	
Figs, in cases	74	5	370	
Flour, in barrels	40	5	200	
Molasses, in barrels	48	5	240	
Rice, in bags	58	6	348	250 to 300
Sal soda, in barrels	46	5	230	
Salt, in bags	70	5	350	
Soap powder, in cases	38	8	304	
Starch, in barrels	25	6	150	
Sugar, in cases	51	6	306	
Sugar, in barrels	43	5	215	
Tea, in chests	25	8	200	
Wines and liquors, in barrels	38	6	228	
Dry goods, cotton, wool, etc.:				
Burlap, in bales	43	6	258	
Coir yarn, in bales	33	8	264	
Cotton, in bales, compressed	18	8	144	
Cotton bleached goods, in cases	28	8	224	
Cotton flannel, in cases	12	8	96	
Cotton sheeting, in cases	23	8	184	
Cotton yarn, in cases	25	8	200	
Excelsior, compressed	19	8	152	
Hemp, Italian, compressed	22	8	176	
Hemp, manila, compressed	30	8	240	200 to 250
Jute, compressed	41	8	328	
Linen damask, in cases	50	5	250	
Linen goods, in cases	30	8	240	
Linen towels, in cases	40	6	240	
Sisal, compressed	21	8	168	
Tow, compressed	29	8	232	
Wool, in bales, compressed	48			
Wool, in bales, not compressed	13	8	104	
Wool, worsteds, in cases	27	8	216	

Specific Gravities and Weights per Cubic Foot for Various Substances

The basis for specific gravities is pure water at 62°F., barometer 30 in. Weight of 1 cu. ft. of water, 62.355 lb.	Average specific gravity, water = 1	Average weight of 1 cu. ft., pounds
Alcohol	0.79	49
Aluminum, cast	2.56	160
Amber	1.08	67
Asbestos	2.1 to 3.0	155
Asbestos sheeting-paper	1.20	75
Asphalt, for street-paving	1.60	100
Asphaltum	1.11 to 1.23	72
Basalt or trap-rock, average	2.9	180
Beeswax	0.95	59
Bismuth, cast	9.76 to 9.90	611
Brass (copper and zinc), cast	7.8 to 9	524
Bricks, common	1.93	120
Bricks, pressed	2.25	140
Bricks, fire	2.40	150
Brickwork, medium quality	1.92	120
Bronze, ordinary	8.6	536
Cadmium	8.6 to 8.7	8.6
Cement, Portland	.....	96
Chalk	2.4	150
Charcoal of pines and oaks	.....	15 to 30
Chromium	6.90	
Clay, compact	1.90	119
Clay, dry, in lump, loose	.....	63
Coal, anthracite, 1.3 to 1.84; of Penn	1.3 to 1.7	1.5 94
Coal, anthracite, broken of any size, loose, average	0.865	54
Coal, bituminous, solid	1.2 to 1.5	1.35 84
Coal, bituminous, moderately shaken	.....	51 to 56
Coke, loose, good quality	0.37–0.51	23 to 32
Concrete, stone	130 to 150	 145
Concrete, cinder	100 to 110	 110
Copper, cast	8.6 to 8.9	8.82 550
Cork, dry	0.24	15
Creosote oil	1.05	65
Earth, common loam, perfectly dry, loose	.....	72 to 80
Earth, common loam, perfectly dry, shaken	.....	80 to 90
Earth, common loam, perfectly dry, rammed	.....	90 to 100
Earth, common loam, moist, packed	.....	90 to 100
Earth, common loam, as soft, flowing mud	.....	105 to 112
Feldspar	2.57	160
Flint	2.60	162
Flour, loose	.....	30
Glass, plate	2.70	168
Glass, window	2.50	155
Gold, pure	19.5	1,216
Granites and gneiss	2.72	170
Graphite	2.25	140
Gravel, dry	.....	115
Gravel, wet	.....	125
Greenstone, trap	2.8 to 3.2	3.0 187
Gutta-percha	0.98	61
Gypsum, rock, unturned	2.30	143
Gypsum, calcined, plaster of paris, loose	.....	55 to 65
Gypsum, plaster of paris, shaken	.....	65 to 75
Hay, baled	.....	24
Hay, loose, in stacks	.....	4
Ice	0.88 to 0.914	0.90 56
Iron, cast	6.9 to 7.4	7.21 450
Iron, wrought	.....	7.7 480
Lead, commercial, cast		11.36 708

SPECIFIC GRAVITIES AND WEIGHTS PER CUBIC FOOT FOR VARIOUS SUBSTANCES.—(*Continued*)

The basis for specific gravities is pure water at 62°F., barometer 30 in. Weight of 1 cu. ft. of water, 62.355 lb.	Average specific gravity, water = 1	Average weight of 1 cu. ft., pounds
Limestone, Indiana	2.50	156
Marble, average	2.60	162
Masonry, granite, dressed	.....	165
Masonry, granite, rubble in cement	.....	155
Masonry, limestone, dressed	.....	155
Masonry, marble, dressed for buildings	.....	165
Masonry, sandstone	.....	145
Mercury, at 32°F	13.62	849
Mica	2.93	183
Mortar, cement	.....	105
Nickel	8.67	540
Paper	.....	60
Paraffin	0.90	56
Petroleum, oil	0.87	54
Platinum	21.5	1,340
Pumice-stone	0.92	57
Quartz	2.65	165
Resin	8.94	557
Rubber, India	0.93	58
Salt, coarse	.....	45
Saltpetre	2.02	126
Sand, of pure quartz, perfectly dry and loose	.....	90 to 105
Sandstone, average	2.41	150
Shales, red or black	2.60	162
Silver	10.50	655
Slate	2.80	175
Snow, freshly fallen	.....	5 to 12
Snow, moistened, compacted by rain	.....	15 to 50
Soapstone	2.72	170
Spelter	7.10	443
Steel	7.86	490
Sugar	1.60	100
Sulphur	2.0	125
Talc	2.81	175
Tar	1.1	69
Tin, cast	7.3	455
Water, pure, rain, distilled, at 62°F., barometer 30 in.	1.00	62.355
Water, sea	1.028	64.1

Decimals of an Inch and of a Foot

Fractions of inch or foot		Inch equivalents to foot fractions	Fractions of inch or foot		Inch equivalents to foot fractions	Fractions of inch or foot		Inch equivalents to foot fractions	Fractions of inch or foot		Inch equivalents to foot fractions
	0.0052	1/16		0.2552	3 1/16		0.5052	6 1/16		0.7552	9 1/16
	0.0104	1/8		0.2604	3 1/8		0.5104	6 1/8		0.7604	9 1/8
1/64	0.015625	3/16	17/64	0.265625	3 3/16	33/64	0.515625	6 3/16	49/64	0.765625	9 3/16
	0.0208	1/4		0.2708	3 1/4		0.5208	6 1/4		0.7708	9 1/4
	0.0260	5/16		0.2760	3 5/16		0.5260	6 5/16		0.7760	9 5/16
1/32	0.03125	3/8	9/32	0.28125	3 3/8	17/32	0.53125	6 3/8	25/32	0.78125	9 3/8
	0.0365	7/16		0.2865	3 7/16		0.5365	6 7/16		0.7865	9 7/16
	0.0417	1/2		0.2917	3 1/2		0.5417	6 1/2		0.7917	9 1/2
3/64	0.046875	9/16	19/64	0.296875	3 9/16	35/64	0.546875	6 9/16	51/64	0.796875	9 9/16
	0.0521	5/8		0.3021	3 5/8		0.5521	6 5/8		0.8021	9 5/8
	0.0573	11/16		0.3073	3 11/16		0.5573	6 11/16		0.8073	9 11/16
1/16	0.0625	3/4	5/16	0.3125	3 3/4	9/16	0.5625	6 3/4	13/16	0.8125	9 3/4
	0.0677	13/16		0.3177	3 13/16		0.5677	6 13/16		0.8177	9 13/16
	0.0729	7/8		0.3229	3 7/8		0.5729	6 7/8		0.8229	9 7/8
5/64	0.078125	15/16	21/64	0.328125	3 15/16	37/64	0.578125	6 15/16	53/64	0.828125	9 15/16
	0.0833	1		0.3333	4		0.5833	7		0.8333	10
	0.0885	1 1/16		0.3385	4 1/16		0.5885	7 1/16		0.8385	10 1/16
3/32	0.09375	1 1/8	11/32	0.34375	4 1/8	19/32	0.59375	7 1/8	27/32	0.84375	10 1/8
	0.0990	1 3/16		0.3490	4 3/16		0.5990	7 3/16		0.8490	10 3/16
	0.1042	1 1/4		0.3542	4 1/4		0.6042	7 1/4		0.8542	10 1/4
7/64	0.109375	1 5/16	23/64	0.359375	4 5/16	39/64	0.609375	7 5/16	55/64	0.859375	10 5/16
	0.1146	1 3/8		0.3646	4 3/8		0.6146	7 3/8		0.8646	10 3/8
	0.1198	1 7/16		0.3698	4 7/16		0.6198	7 7/16		0.8698	10 7/16
1/8	0.1250	1 1/2	3/8	0.3750	4 1/2	5/8	0.6250	7 1/2	7/8	0.8750	10 1/2
	0.1302	1 9/16		0.3802	4 9/16		0.6302	7 9/16		0.8802	10 9/16
	0.1354	1 5/8		0.3854	4 5/8		0.6354	7 5/8		0.8854	10 5/8
9/64	0.140625	1 11/16	25/64	0.390625	4 11/16	41/64	0.640625	7 11/16	57/64	0.890625	10 11/16
	0.1458	1 3/4		0.3958	4 3/4		0.6458	7 3/4		0.8958	10 3/4
	0.1510	1 13/16		0.4010	4 13/16		0.6510	7 13/16		0.9010	10 13/16
5/32	0.15625	1 7/8	13/32	0.40625	4 7/8	21/32	0.65625	7 7/8	29/32	0.90625	10 7/8
	0.1615	1 15/16		0.4115	4 15/16		0.6615	7 15/16		0.9115	10 15/16
	0.1667	2		0.4167	5		0.6667	8		0.9167	11
11/64	0.171875	2 1/16	27/64	0.421875	5 1/16	43/64	0.671875	8 1/16	59/64	0.921875	11 1/16
	0.1771	2 1/8		0.4271	5 1/8		0.6771	8 1/8		0.9271	11 1/8
	0.1823	2 3/16		0.4323	5 3/16		0.6823	8 3/16		0.9323	11 3/16
3/16	0.1875	2 1/4	7/16	0.4375	5 1/4	11/16	0.6875	8 1/4	15/16	0.9375	11 1/4
	0.1927	2 5/16		0.4427	5 5/16		0.6927	8 5/16		0.9427	11 5/16
	0.1979	2 3/8		0.4479	5 3/8		0.6979	8 3/8		0.9479	11 3/8
13/64	0.203125	2 7/16	29/64	0.453125	5 7/16	45/64	0.703125	8 7/16	61/64	0.953125	11 7/16
	0.2083	2 1/2		0.4583	5 1/2		0.7083	8 1/2		0.9583	11 1/2
	0.2135	2 9/16		0.4635	5 9/16		0.7135	8 9/16		0.9635	11 9/16
7/32	0.21875	2 5/8	15/32	0.46875	5 5/8	23/32	0.71875	8 5/8	31/32	0.96875	11 5/8
	0.2240	2 11/16		0.4740	5 11/16		0.7240	8 11/16		0.9740	11 11/16
	0.2292	2 3/4		0.4792	5 3/4		0.7292	8 3/4		0.9792	11 3/4
15/64	0.234375	2 13/16	31/64	0.484375	5 13/16	47/64	0.734375	8 13/16	63/64	0.984375	11 13/16
	0.2396	2 7/8		0.4896	5 7/8		0.7396	8 7/8		0.9896	11 7/8
	0.2448	2 15/16		0.4948	5 15/16		0.7448	8 15/16		0.9948	11 15/16
1/4	0.2500	3	1/2	0.5000	6	3/4	0.7500	9	1	1.0000	12

Standard Gages

Comparative table

Gage number	Thickness in decimals of an inch					
	Birmingham Wire (B. W. G.) also known as Stubs Iron Wire	American Wire or Browne & Sharpe	American Steel & Wire Co. formerly Washburn & Moen	Trenton Iron Company	British Imperial Standard Wire (S. W. G.)	Standard Birmingham Sheet and Hoop (B. G.)
0000000	0....	0.....	0.4900	.....	0.500	
000000	0....	0.580000	0.4615	.....	0.464	
00000	0.500	0.516500	0.4305	0.450	0.432	
0000	0.454	0.460000	0.3938	0.400	0.400	
000	0.425	0.409642	0.3625	0.360	0.372	0.5000
00	0.380	0.364796	0.3310	0.330	0.348	0.4452
0	0.340	0.324861	0.3065	0.305	0.324	0.3964
1	0.300	0.289297	0.2830	0.285	0.300	0.3532
2	0.284	0.257627	0.2625	0.265	0.276	0.3147
3	0.259	0.229423	0.2437	0.245	0.252	0.2804
4	0.238	0.204307	0.2253	0.225	0.232	0.2500
5	0.220	0.181940	0.2070	0.205	0.212	0.2225
6	0.203	0.162023	0.1920	0.190	0.192	0.1981
7	0.180	0.144285	0.1770	0.175	0.176	0.1764
8	0.165	0.128490	0.1620	0.160	0.160	0.1570
9	0.148	0.114423	0.1483	0.145	0.144	0.1398
10	0.134	0.101897	0.1350	0.130	0.128	0.1250
11	0.120	0.090742	0.1205	0.1175	0.116	0.1113
12	0.109	0.080808	0.1055	0.105	0.104	0.0991
13	0.095	0.071962	0.0915	0.0925	0.092	0.0882
14	0.083	0.064084	0.0800	0.0806	0.080	0.0785
15	0.072	0.057068	0.0720	0.070	0.072	0.0699
16	0.065	0.050821	0.0625	0.061	0.064	0.0625
17	0.058	0.045257	0.0540	0.0525	0.056	0.0556
18	0.049	0.040303	0.0475	0.045	0.048	0.0495
19	0.042	0.035890	0.0410	0.040	0.040	0.0440
20	0.035	0.031961	0.0348	0.035	0.036	0.0392
21	0.032	0.028462	0.03175	0.031	0.032	0.0349
22	0.028	0.025346	0.0286	0.028	0.028	0.03125
23	0.025	0.022572	0.0258	0.025	0.024	0.02782
24	0.022	0.020101	0.0230	0.0225	0.022	0.02476
25	0.020	0.017900	0.0204	0.020	0.020	0.02204
26	0.018	0.015941	0.0181	0.018	0.018	0.01961
27	0.016	0.014195	0.0173	0.017	0.0164	0.01745
28	0.014	0.012641	0.0162	0.016	0.0148	0.015625
29	0.013	0.011257	0.0150	0.015	0.0136	0.0139
30	0.012	0.010025	0.0140	0.014	0.0124	0.0123
31	0.010	0.008928	0.0132	0.013	0.0116	0.0110
32	0.009	0.007950	0.0128	0.012	0.0108	0.0098
33	0.008	0.007080	0.0118	0.011	0.0100	0.0087
34	0.007	0.006305	0.0104	0.010	0.0092	0.0077
35	0.005	0.005615	0.0095	0.0095	0.0084	0.0069
36	0.004	0.005000	0.0090	0.009	0.0076	0.0061
37	.....	0.004453	0.0085	0.0085	0.0068	0.0054
38	.....	0.003965	0.0080	0.008	0.0060	0.0048
39	.....	0.003531	0.0075	0.0075	0.0052	
40	.....	0.003144	0.0070	0.007	0.0048	

WEIGHTS AND MEASURES

Linear Measure

United States and British

Inches	Feet	Yards	Rods	Furlong	Miles
1	0.08333	0.02778	0.0050505	0.00012626	0.00001578
12	1.	0.33333	0.0606061	0.00151515	0.00018939
36	3.	1.	0.1818182	0.00454545	0.00056818
198	16.5	5.5	1.	0.025	0.003125
7920	660.	220.	40.	1.	0.125
63360	5280.	1760.	320.	8.	1.

Rope and Cable Measure

1 inch = 0.111111 span = 0.013889 fathom = 0.0001157 cable's length.
1 span = 9 inches = 0.125 fathom = 0.00104167 cable's length.
1 fathom = 6 feet = 8 spans = 72 inches = 0.008333 cable's length.
1 cable's length = 120 fathoms = 720 feet = 960 spans = 8640 inches.

Nautical Measure

1 nautical mile, as adopted by the United States Coast and Geodetic Survey, equals the length of one minute of arc of a great circle of a sphere whose surface equal that of the earth = 6080.204 feet = 1.1516 statute miles.

1 league = 3 nautical miles = 18240.613 feet.

Gunter's Chain

1 link = 7.92 inches = 0.01 chain = 0.000125 mile.
1 chain = 100 links = 66 feet = 4 rods = 0.0125 mile.
1 mile = 80 chains = 8000 links.

Square or Land Measure

United States and British

Square inches	Square feet	Square yards	Square rods	Acres	Square miles
1	0.006944	0.0007716			
144	1.	0.111111			
1296	9.0	1.	0.03306	0.0002066	
39204	272.25	30.25	1.	0.00625	0.00000977
6272640	43560.	4840.	160.	1.	0.0015625
	27878400.	3097600.	102400.	640.	1.

1 square rood = 40 square rods.
1 acre = 4 square roods.
1 acre = 208.71 feet square.

WEIGHTS AND MEASURES

Avoirdupois Weight

United States and British

Grains	Drams	Ounces	Pounds	Hundred-weight	Gross tons
1.	0.03657	0.002286	0.000143	0.00000128	0.000000176
27.34375	1.	0.0625	0.003906	0.00003488	0.000001744
437.5	16.	1.	0.0625	0.00055804	0.00002790
7000.	256.	16.	1.	0.0089286	0.0004464
784000.	28672.	1792.	112.	1.	0.05
5680000.	573440.	35840.	2240.	20.	1.

1 pound avoirdupois = 1.215278 pounds troy.
1 net ton = 2000 pounds = 0.892857 gross ton.

Troy Weight

United States and British

Grains	Pennyweight	Ounces	Pounds
1	0.041667	0.0020833	0.0001736
24	1.	0.05	0.0041667
480	20.	1.	0.0833333
5760	240.	12.	1.

1 pound troy = 0.822857 pound avoirdupois.
175 ounces troy = 192 ounces avoirdupois.

Apothecaries' Weight

United States and British

Grains	Scruples	Drams	Ounces	Pounds
1	0.05	0.016667	0.0020833	0.000173611
20	1.	0.333333	0.0416667	0.0034722
60	3.	1.	0.125	0.0104167
480	24.	8.	1.	0.0833333
5760	288.	96.	12.	1.

The pound, ounce and grain are the same as in troy weight.
The avoirdupois grain = troy grain = apothecaries' grain.

WEIGHTS AND MEASURES

Cubic or Solid Measure

United States and British

1 cubic inch = 0.0005787 cubic foot = 0.000021433 cubic yard.

1 cubic foot = 1728 cubic inches = 0.03703704 cubic yard.

1 cubic yard = 27 cubic feet = 46656 cubic inches.

1 cord of wood = 128 cubic feet = 4 feet by 4 feet by 8 feet.

1 perch of masonry = 24.75 cubic feet = 16.5 feet by 1.5 feet by 1 foot. It is usually taken as 25 cubic feet.

Dry Measure

United States only

Pints	Quarts	Gallons	Pecks	Bushels	Cubic inches
1	0.50	0.125	0.0625	0.015625	33.6003125
2	1.	0.25	0.125	0.03125	67.200625
8	4.	1.	0.05	0.125	268.8025
16	8.	2.	1.	0.25	537.605
64	32.	8.	4.	1.	2150.42

1 heaped bushel = 1.25 struck bushel, and the cone must be not less than 6 inches high.

Liquid Measure

United States only

Gills	Pints	Quarts	Gallons	Barrels	Cubic inches
1	0.25	0.125	0.03125	0.000498	7.21875
4	1.	0.5	0.125	0.003968	28.875
8	2.	1.	0.25	0.007937	57.75
32	8.	4.	1.	0.031746	231.
2,008	252.	126.	31.5	1.	7,276.5

The British imperial gallon = 277.410 cubic inches or 10 pounds avoirdupois of pure water at 62°F. and barometer at 30 inches.

The British imperial gallon = 1.20091 United States gallons.

1 fluid drachm = 60 minims = 0.125 fluid ounce = 0.0078125 pint.

1 fluid ounce = 480 minims = 8 drachms = 0 .0625 pint.

Metric Conversion Table

Simple Units

Length

Centimeter .3937 inches
Meter = 3.28 feet
Meter = 1.09 yards
Kilometer = 0.621 mile
Inch = 2.54 centimeters
Foot = 0 305 meter
Yard = 0.914 meter
Mile = 1.61 kilometers

Area

Square centimeter = 0.155 square inch
Square meter = 10.764 square feet
Square meter = 1.196 square yards
Square kilometer = 0.386 square mile
Square inch = 6.452 square centimeters
Square foot = 0.0929 square meter
Square yard = 0.836 square meter
Square mile = 2.59 square kilometers

Volume

Cubic centimeter = 0.061 cubic inch
Cubic millimeter = 35.29 cubic feet
Cubic millimeter = 1.308 cubic yard
Cubic inch = 16.4 cubic centimeters
Cubic foot = 0.028 cu ic meter
Cubic yard = 0.765 cubic meter

Capacity

Liter = 0.0353 cubic foot
Liter = 0.2642 gallon (United States)
Liter = 61.023 cubic incher
(Liter = 2.202 ounds of water at 62°F.)
Cubic foot = 28.32 liters
Gallon = 3.785 liters
Cubic inch = 0.0164 liter

Weight

Gram = 15.432 grains
Gram = 0.353 ounce
Kilogram = 2.205 pounds
Kilogram =0 .0011 ton
Tonne = 1.1025 tons
Grain = 0.0648 gram
Ounce = 28.35 grams
Pound = 0.454 kilogram
Ton = 907.03 kilograms
Ton = 0.907 tonne
(Ton = 2000 pounds)

Compound Units

Pressure

Kilogram per square centimeter = 14.225 pounds per square inch
Pound per square inch = 0.0703 kilogram per square centimeter
Kilogram per square meter = 0.205 pound per square foot
Pound per square foot = 4.88 kilograms per square meter
Kilogram per square centimeter = 0.968 atmosphere
Atmosphere = 1.033 kilograms per square centimeter

Weight

Gram per cubic meter = 0.437 grain per cubic foot
Grain per cubic foot = 2.288 grams per cubic meter
Kilogram per cubic meter = 0.0624 pound per cubic foot
Pound per cubic foot = 16.02 k lograms per cubic meter
Kilogram per liter = 8.33 pounds per United States gallon
Pound per gallon = 0.12 kilogram per liter

Heat

Centigrade (degree) = 5/9 Fahrenheit degree −32
Fahrenheit (degree) = 9/5 Centigrade degree +32
Calorie = 3.968 B.t.u.
B.t.u. =0 .252 calorie
Calorie per kilogram = 1.8 B.t.u. per pound
B.t.u. per pound = .5556 calorie per kilogram
Calorie per liter = 112.366 B.t.u. per cubic foot
B.t.u. per cubic foot = 0.00889 calorie per liter
Calorie per cubic meter = 8.99 B.t.u. per cubic foot
B.t.u. per cubic foot = 0.1125 calorie per cubic meter

Miscellaneous

Kilogram-meter = 7.233 foot-pounds
Foot pound = 0.1384 kilogram-meter
Cheval (Franch horsepower) = 0.986 horsepower
Horsepower 1.014 Cheval
Liter per second = 2.12 cubic feet per minute
Liter per second = 4.74 United States gallons per minute
Liter per cubic meter = 0.798 United States gallon per cubic foot
Gallon per cubic foot = 1.254 liters per cubic meter

CIRCLES AND SPHERES

To find the circumference of a circle, multiply the diameter by 3.1416.

To find the diameter, multiply circumference by 0.3183 or divide circumference by 3.1416.

To find the radius, multiply circumference by 0.15915.

To find the side of an inscribed square, multiply the diameter by 0.07071 or multiply the circumference by 0.2251.

To find the side of an equal square, multiply the diameter by 0.8862 or multiply the circumference by 0.2821.

Square. A side multiplied by 1.1142 equals the diameter of its circumscribing circle.

A side multiplied by 4.443 equals the circumference of its circumscribing circle.

A side multiplied by 1.128 equals the diameter of an equal circle.

A side multiplied by 3.547 equals circumference of an equal circle.

To find the area of a circle, multiply the circumference by one-quarter of the diameter or multiply the square of the diameter by 0.7854 or multiply the square of the circumference by 0.07958 or multiply the square of one-half the diameter by 3.1416.

To find the surface of a sphere or globe, multiply the diameter by the circumference or multiply the square of the diameter by 3.1416 or multiply four times the square of the radius by 3.1416.

PRISMOIDAL FORMULAE

To figure the correct volume of excavation, concrete piers, etc. where the shape is not rectangular, the prismoidal formula, while not the quickest method gives the correct amount. A prismoid is a

solid having plane parallel bases or ends, and bounded on the sides either by planes, or by such surfaces as may be generated by a right line moving continuously along the edges of the bases as directrices.

Formulae and Method of Application.—The contents of a prismoid may be calculated by means of the following formula:

$$S = \frac{h}{6}(B + 4B' + b)$$

Where S is the volume in cubic feet, h is the height in feet, B the area of the larger base, b the area of the smaller base, and B' the area of section midway between the two ends. This area is not a mean of the other two, but the linear dimensions of the midsection are means of corresponding dimensions severally of the end section, from which therefore the area of the midsection can be computed. To illustrate: if a concrete pier is 4 by 4 ft. at the base, 2 by 2 ft. at the top, and 4 ft. high, the volume would be as follows:

$$S = \tfrac{4}{6}(16 + 36 + 4) = 37\tfrac{1}{3} \text{ cu. ft.}$$

Such piers are sometimes figured by using the average of the two ends for the area, while others figure the actual midsection area for the base to be used. The first method, or average of the ends, would give 40 cu. ft., while the midsection method would give 36 cu. ft. It is evident, therefore, that the midsection method is better than the average end method, but neither of these methods gives the correct answer.

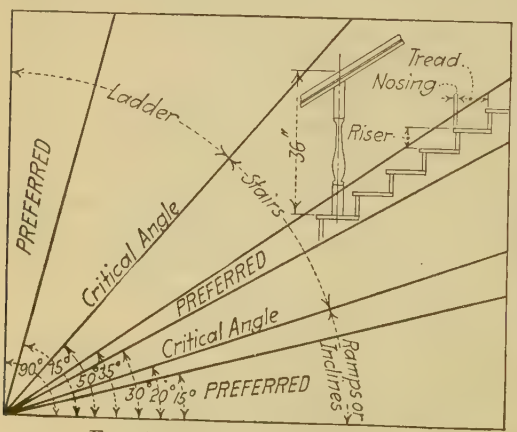


TABLE OF RISERS AND TREADS FOR STAIRS
(Tread + Riser = 17½")

ANGLE WITH HORIZONTAL	RISER IN INCHES	TREAD IN INCHES	
22° - 00'	5	12½	
23° - 14'	5¼	12¼	
24° - 38'	5½	12	
26° - 00'	5¾	11¾	
27° - 33'	6	11½	
29° - 03'	6¼	11¼	
30° - 35'	6½	11	
32° - 08'	6¾	10¾	PFD
33° - 41'	7	10½	
35° - 16'	7¼	10¼	
36° - 52'	7½	10	
38° - 29'	7¾	9¾	
40° - 08'	8	9½	
41° - 44'	8¼	9¼	
43° - 22'	8½	9	
45° - 00'	8¾	8¾	
46° - 38'	9	8½	
48° - 16'	9¼	8¼	
49° - 54'	9½	8	

FIG. 1.—Standard incline for stairs, ladders and ramps.

Functions of Numbers, 1 to 49

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter: Circum.	No. = Diameter: Area
1	1	1	1.0000	1.0000	0.00000	1000.000	3.142	0.7854
2	4	8	1.4142	1.2599	0.30103	500.000	6.283	3.1416
3	9	27	1.7321	1.4422	0.47712	333.333	9.425	7.0686
4	16	64	2.0000	1.5874	0.60206	250.000	12.566	12.5664
5	25	125	2.2361	1.7100	0.69897	200.000	15.708	19.6350
6	36	216	2.4495	1.8171	0.77815	166.667	18.850	28.2743
7	49	343	2.6458	1.9129	0.84510	142.857	21.991	38.4845
8	64	512	2.8284	2.0000	0.90309	125.000	25.133	50.2655
9	81	729	3.0000	2.0801	0.95424	111.111	28.274	63.6173
10	100	1000	3.1623	2.1544	1.00000	100.000	31.416	78.5398
11	121	1331	3.3166	2.2240	1.04139	90.9091	34.558	95.0332
12	144	1728	3.4641	2.2894	1.07918	83.3333	37.699	113.097
13	169	2197	3.6056	2.3513	1.11394	76.9231	40.841	132.732
14	196	2744	3.7417	2.4101	1.14613	71.4286	43.982	153.938
15	225	3375	3.8730	2.4662	1.17609	66.6667	47.124	176.715
16	256	4096	4.0000	2.5198	1.20412	62.5000	50.265	201.062
17	289	4913	4.1231	2.5713	1.23045	58.8235	53.407	226.980
18	324	5832	4.2426	2.6207	1.25527	55.5556	56.549	254.469
19	361	6859	4.3589	2.6684	1.27875	52.6316	59.690	283.529
20	400	8000	4.4721	2.7144	1.30103	50.0000	62.832	314.159
21	441	9261	4.5826	2.7589	1.32222	47.6190	65.973	346.361
22	484	10648	4.6904	2.8020	1.34242	45.4545	69.115	380.133
23	529	12167	4.7958	2.8439	1.36173	43.4783	72.257	415.476
24	576	13824	4.8990	2.8845	1.38021	41.6667	75.398	452.389
25	625	15625	5.0000	2.9240	1.39794	40.0000	78.540	490.874
26	676	17576	5.0990	2.9625	1.41497	38.4615	81.681	530.929
27	729	19683	5.1962	3.0000	1.43136	37.0370	84.823	572.555
28	784	21952	5.2915	3.0366	1.44716	35.7143	87.965	615.752
29	841	24389	5.3852	3.0723	1.46240	34.4828	91.106	660.520
30	900	27000	5.4772	3.1072	1.47712	33.3333	94.248	706.858
31	961	29791	5.5678	3.1414	1.49136	32.2581	97.389	754.768
32	1024	32768	5.6569	3.1748	1.50515	31.2500	100.531	804.248
33	1089	35937	5.7446	3.2075	1.51851	30.3030	103.673	855.299
34	1156	39304	5.8310	3.2396	1.53148	29.4118	106.814	907.920
35	1225	42875	5.9161	3.2711	1.54407	28.5714	109.956	962.113
36	1296	46656	6.0000	3.3019	1.55630	27.7778	113.097	1017.88
37	1369	50653	6.0828	3.3322	1.56820	27.0270	116.239	1075.21
38	1444	54872	6.1644	3.3620	1.57978	26.3158	119.381	1134.11
39	1521	59319	6.2450	3.3912	1.59106	25.6410	122.522	1194.59
40	1600	64000	6.3246	3.4200	1.60206	25.0000	125.66	1256.64
41	1681	68921	6.4031	3.4482	1.61278	24.3902	128.81	1320.25
42	1764	74088	6.4807	3.4760	1.62325	23.8095	131.95	1385.44
43	1849	79507	6.5574	3.5034	1.63347	23.2558	135.09	1452.20
44	1936	85184	6.6332	3.5303	1.64345	22.7273	138.23	1520.53
45	2025	91125	6.7082	3.5569	1.65321	22.2222	141.37	1590.43
46	2116	97336	6.7823	3.5830	1.66276	21.7391	144.51	1661.90
47	2209	103823	6.8557	3.6088	1.67210	21.2766	147.65	1734.94
48	2304	110592	6.9282	3.6342	1.68124	20.8333	150.80	1809.56
49	2401	117649	7.0000	3.6593	1.69020	20.4082	153.94	1885.74

Functions of Numbers 50 to 99

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter	
							Circum.	Area
50	2500	125000	7.0711	3.6840	1.69897	20.0000	157.08	1963.50
51	2601	132651	7.1414	3.7084	1.70757	19.6078	160.22	2042.82
52	2704	140608	7.2111	3.7325	1.71600	19.2308	163.36	2123.72
53	2809	148877	7.2801	3.7563	1.72428	18.8679	166.50	2206.18
54	2916	157464	7.3485	3.7798	1.73239	18.5185	169.65	2290.22
55	3025	166375	7.4162	3.8030	1.74036	18.1818	172.79	2375.83
56	3136	175616	7.4833	3.8259	1.74819	17.8571	175.93	2463.01
57	3249	185193	7.5498	3.8485	1.75587	17.5439	179.07	2551.76
58	3364	195112	7.6158	3.8709	1.76343	17.2414	182.21	2642.08
59	3481	205379	7.6811	3.8930	1.77085	16.9492	185.35	2733.97
60	3600	216000	7.7460	3.9149	1.77815	16.6667	188.50	2827.43
61	3721	226981	7.8102	3.9365	1.78533	16.3934	191.64	2922.47
62	3844	238328	7.8740	3.9579	1.79239	16.1290	194.78	3019.07
63	3969	250047	7.9373	3.9791	1.79934	15.8730	197.92	3117.25
64	4096	262144	8.0000	4.0000	1.80618	15.6250	201.06	3216.99
65	4225	274625	8.0623	4.0207	1.81291	15.3846	204.20	3318.31
66	4356	287496	8.1240	4.0412	1.81954	15.1515	207.35	3421.19
67	4489	300763	8.1854	4.0615	1.82607	14.9254	210.49	3525.65
68	4624	314432	8.2462	4.0817	1.83251	14.7059	213.63	3631.68
69	4761	328509	8.3066	4.1016	1.83885	14.4928	216.77	3739.28
70	4900	343000	8.3666	4.1213	1.84510	14.2857	219.91	3848.45
71	5041	357911	8.4261	4.1408	1.85126	14.0845	223.05	3959.19
72	5184	373248	8.4853	4.1602	1.85733	13.8889	226.19	4071.50
73	5329	389017	8.5440	4.1793	1.86332	13.6986	229.34	4185.39
74	5476	405224	8.6023	4.1983	1.86923	13.5135	232.48	4300.84
75	5625	421875	8.6603	4.2172	1.87506	13.3333	235.62	4417.86
76	5776	438976	8.7178	4.2358	1.88081	13.1579	238.76	4536.46
77	5929	456533	8.7750	4.2543	1.88649	12.9870	241.90	4656.63
78	6084	474552	8.8318	4.2727	1.89209	12.8205	245.04	4778.36
79	6241	493039	8.8882	4.2908	1.89763	12.6582	248.19	4901.67
80	6400	512000	8.9443	4.3089	1.90309	12.5000	251.33	5026.55
81	6561	531441	9.0000	4.3267	1.90849	12.3457	254.47	5153.00
82	6724	551368	9.0554	4.3445	1.91381	12.1951	257.61	5281.02
83	6889	571787	9.1104	4.3621	1.91908	12.0482	260.75	5410.61
84	7056	592704	9.1652	4.3795	1.92428	11.9048	263.89	5541.77
85	7225	614125	9.2195	4.3968	1.92942	11.7647	267.04	5674.50
86	7396	636056	9.2736	4.4140	1.93450	11.6279	270.18	5808.80
87	7569	658503	9.3274	4.4310	1.93952	11.4943	273.32	5944.68
88	7744	681472	9.3808	4.4480	1.94448	11.3636	276.46	6082.12
89	7921	704969	9.4340	4.4647	1.94939	11.2360	279.60	6221.14
90	8100	729000	9.4868	4.4814	1.95424	11.1111	282.74	6361.73
91	8281	753571	9.5394	4.4979	1.95904	10.9890	285.88	6503.88
92	8464	778688	9.5917	4.5144	1.96379	10.8696	289.03	6647.61
93	8649	804357	9.6437	4.5307	1.96848	10.7527	292.17	6792.91
94	8836	830584	9.6954	4.5468	1.97313	10.6383	295.31	6939.78
95	9025	857375	9.7468	4.5629	1.97772	10.5263	298.45	7088.22
96	9216	884736	9.7980	4.5789	1.98227	10.4167	301.59	7238.23
97	9409	912673	9.8489	4.5947	1.98677	10.3093	304.73	7389.81
98	9604	941192	9.8995	4.6104	1.99123	10.2041	307.88	7542.96
99	9801	970299	9.9499	4.6261	1.99564	10.1010	311.02	7697.69

Functions of Numbers, 100 to 149

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter	
							Circum.	Area
100	10000	1000000	10.0000	4.6416	2.00000	10.0000	314.16	7853.98
101	10201	1030301	10.0499	4.6570	2.00432	9.90099	317.30	8011.85
102	10404	1061208	10.0995	4.6723	2.00860	9.80392	320.44	8171.28
103	10609	1092727	10.1489	4.6875	2.01284	9.70874	323.58	8332.29
104	10816	1124864	10.1980	4.7027	2.01703	9.61538	326.73	8494.87
105	11025	1157625	10.2470	4.7177	2.02119	9.52381	329.87	8659.01
106	11236	1191016	10.2956	4.7326	2.02531	9.43396	333.01	8824.73
107	11449	1225043	10.3441	4.7475	2.02938	9.34579	336.15	8992.02
108	11664	1259712	10.3923	4.7622	2.03342	9.25926	339.29	9160.88
109	11881	1295029	10.4403	4.7769	2.03743	9.17431	342.43	9331.32
110	12100	1331000	10.4881	4.7914	2.04139	9.09091	345.58	9503.32
111	12321	1367631	10.5357	4.8059	2.04532	9.00901	348.72	9676.89
112	12544	1404928	10.5830	4.8203	2.04922	8.92857	351.86	9852.03
113	12769	1442897	10.6301	4.8346	2.05308	8.84956	355.00	10028.7
114	12996	1481544	10.6771	4.8488	2.05690	8.77193	358.14	10207.0
115	13225	1520875	10.7238	4.8629	2.06070	8.69565	361.28	10386.9
116	13456	1560896	10.7703	4.8770	2.06446	8.62069	364.42	10568.3
117	13689	1601613	10.8167	4.8910	2.06819	8.54701	367.57	10751.3
118	13924	1643032	10.8628	4.9049	2.07188	8.47458	370.71	10935.9
119	14161	1685159	10.9087	4.9187	2.07555	8.40336	373.85	11122.0
120	14400	1728000	10.9545	4.9324	2.07918	8.33333	376.99	11309.7
121	14641	1771561	11.0000	4.9461	2.08279	8.26446	380.13	11499.0
122	14884	1815848	11.0454	4.9597	2.08636	8.19672	383.27	11689.9
123	15129	1860867	11.0905	4.9732	2.08991	8.13008	386.42	11882.3
124	15376	1906624	11.1355	4.9866	2.09342	8.06452	389.56	12076.3
125	15625	1953125	11.1803	5.0000	2.09691	8.00000	392.70	12271.8
126	15876	2000376	11.2250	5.0133	2.10037	7.93651	395.84	12469.0
127	16129	2048383	11.2694	5.0265	2.10380	7.87402	398.98	12667.7
128	16384	2097152	11.3137	5.0397	2.10721	7.81250	402.12	12868.0
129	16641	2146689	11.3578	5.0528	2.11059	7.75194	405.27	13069.8
130	16900	2197000	11.4018	5.0658	2.11394	7.69231	408.41	13273.2
131	17161	2248091	11.4455	5.0788	2.11727	7.63359	411.55	13478.2
132	17424	2299968	11.4891	5.0916	2.12057	7.57576	414.69	13684.8
133	17689	2352637	11.5326	5.1045	2.12385	7.51880	417.83	13892.9
134	17956	2406104	11.5758	5.1172	2.12710	7.46269	420.97	14102.6
135	18225	2460375	11.6190	5.1299	2.13033	7.40741	424.12	14313.9
136	18496	2515456	11.6619	5.1426	2.13354	7.35294	427.26	14526.7
137	18769	2571353	11.7047	5.1551	2.13672	7.29927	430.40	14741.1
138	19044	2628072	11.7473	5.1676	2.13988	7.24638	433.54	14957.1
139	19321	2685619	11.7898	5.1801	2.14301	7.19424	436.68	15174.7
140	19600	2744000	11.8322	5.1925	2.14613	7.14286	439.82	15393.8
141	19881	2803221	11.8743	5.2048	2.14922	7.09220	442.96	15614.5
142	20164	2863288	11.9164	5.2171	2.15229	7.04225	446.11	15836.8
143	20449	2924207	11.9583	5.2293	2.15534	6.99301	449.25	16060.6
144	20736	2985984	12.0000	5.2415	2.15836	6.94444	452.39	16286.0
145	21025	3048625	12.0416	5.2536	2.16137	6.89655	455.53	16513.0
146	21316	3112136	12.0830	5.2656	2.16435	6.84932	458.67	16741.5
147	21609	3176523	12.1244	5.2776	2.16732	6.80272	461.81	16971.7
148	21904	3241792	12.1655	5.2896	2.17026	6.75676	464.96	17203.4
149	22201	3307949	12.2066	5.3015	2.17319	6.71141	468.10	17436.6

Functions of Numbers, 150 to 199

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter	
							Circum.	Area
150	22500	3375000	12.2474	5.3133	2.17609	6.66667	471.24	17671.5
151	22801	3442951	12.2882	5.3251	2.17898	6.62252	474.38	17907.9
152	23104	3511808	12.3288	5.3368	2.18184	6.57895	477.52	18145.8
153	23409	3581577	12.3693	5.3485	2.18469	6.53595	480.66	18385.4
154	23716	3652264	12.4097	5.3601	2.18752	6.49351	483.81	18626.5
155	24025	3723875	12.4499	5.3717	2.19033	6.45161	486.95	18869.2
156	24336	3796416	12.4900	5.3832	2.19312	6.41026	490.09	19113 4
157	24649	3869893	12.5300	5.3947	2.19590	6.36943	493.23	19359.3
158	24964	3944312	12.5698	5.4061	2.19866	6.32911	496.37	19606.7
159	25281	4019679	12.6095	5.4175	2.20140	6.28931	499.51	19855.7
160	25600	4096000	12.6491	5.4288	2.20412	6.25000	502.65	20106.2
161	25921	4173281	12.6886	5.4401	2.20683	6.21118	505.80	20358.3
162	26244	4251528	12.7279	5.4514	2.20952	6.17284	508.94	20612.0
163	26569	4330747	12.7671	5.4626	2.21219	6.13497	512.08	20867.2
164	26896	4410944	12.8062	5.4737	2.21484	6.09756	515.22	21124.1
165	27225	4492125	12.8452	5.4848	2.21748	6.06061	518.36	21382.5
166	27556	4574296	12.8841	5.4959	2.22011	6.02410	521.50	21642.4
167	27889	4657463	12.9228	5.5069	2.22272	5.98802	524.65	21904.0
168	28224	4741632	12.9615	5.5178	2.22531	5.95238	527.79	22167.1
169	28561	4826809	13.0000	5.5288	2.22789	5.91716	530.93	22431.8
170	28900	4913000	13.0384	5.5397	2.23045	5.88235	534.07	22698.0
171	29241	5000211	13.0767	5.5505	2.23300	5.84795	537.21	22965.8
172	29584	5088448	13.1149	5.5613	2.23553	5.81395	540.35	23235.2
173	29929	5177717	13.1529	5.5721	2.23805	5.78035	543.50	23506.2
174	30276	5268024	13.1909	5.5828	2.24055	5.74713	546.64	23778.7
175	30625	5359375	13.2288	5.5934	2.24304	5.71429	549.78	24052.8
176	30976	5451776	13.2665	5.6041	2.24551	5.68182	552.92	24328.5
177	31329	5545233	13.3041	5.6147	2.24797	5.64972	556.06	24605.7
178	31684	5639752	13.3417	5.6252	2.25042	5.61798	559.20	24884.6
179	32041	5735339	13.3791	5.6357	2.25285	5.58659	562.35	25164.9
180	32400	5832000	13.4164	5.6462	2.25527	5.55556	565.49	25446.9
181	32761	5929741	13.4536	5.6567	2.25768	5.52486	568.63	25730.4
182	33124	6028568	13.4907	5.6671	2.26007	5.49451	571.77	26015.5
183	33489	6128487	13.5277	5.6774	2.26245	5.46448	574.91	26302.2
184	33856	6229504	13.5647	5.6877	2.26482	5.43478	578.05	26590.4
185	34225	6331625	13.6015	5.6980	2.26717	5.40541	581.19	26880.3
186	34596	6434856	13.6382	5.7083	2.26951	5.37634	584.34	27171.6
187	34969	6539203	13.6748	5.7185	2.27184	5.34759	587.48	27464.6
188	35344	6644672	13.7113	5.7287	2.27416	5.31915	590.62	27759.1
189	35721	6751269	13.7477	5.7388	2.27646	5.29101	593.76	28055.2
190	36100	6859000	13.7840	5.7489	2.27875	5.26316	596.90	28352.9
191	36481	6967871	13.8203	5.7590	2.28103	5.23560	600.04	28652.1
192	36864	7077888	13.8564	5.7690	2.28330	5.20833	603.19	28952.9
193	37249	7189057	13.8924	5.7790	2.28556	5.18135	606.33	29255.3
194	37636	7301384	13.9284	5.7890	2.28780	5.15464	609.47	29559.2
195	38025	7414875	13.9642	5.7989	2.29003	5.12821	612.61	29864.8
196	38416	7529536	14.0000	5.8088	2.29226	5.10204	615.75	30171.9
197	38809	7645373	14.0357	5.8186	2.29447	5.07614	618.89	30480.5
198	39204	7762392	14.0712	5.8285	2.29667	5.05051	622.04	30790.7
199	39601	7880599	14.1067	5.8383	2.29885	5.02513	625.18	31102.6

Functions of Numbers, 200 to 249

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter: Circum.	No. = Diameter: Area
200	40000	8000000	14.1421	5.8480	2.30103	5.00000	628.32	31415.9
201	40401	8120601	14.1774	5.8578	2.30320	4.97512	631.46	31730.9
202	40804	8242408	14.2127	5.8675	2.30535	4.95050	634.60	32047.4
203	41209	8365427	14.2478	5.8771	2.30750	4.92611	637.74	32365.5
204	41616	8489664	14.2829	5.8868	2.30963	4.90196	640.88	32685.1
205	42025	8615125	14.3178	5.8964	2.31175	4.87805	644.03	33006.4
206	42436	8741816	14.3527	5.9059	2.31387	4.85437	647.17	33329.2
207	42849	8869743	14.3875	5.9155	2.31597	4.83092	650.31	33653.5
208	43264	8998912	14.4222	5.9250	2.31806	4.80769	653.45	33979.5
209	43681	9129329	14.4568	5.9345	2.32015	4.78469	656.59	34307.0
210	44100	9261000	14.4914	5.9439	2.32222	4.76190	659.73	34636.1
211	44521	9393931	14.5258	5.9533	2.32428	4.73934	662.88	34966.7
212	44944	9528128	14.5602	5.9627	2.32634	4.71698	666.02	35298.9
213	45369	9663597	14.5945	5.9721	2.32838	4.69484	669.16	35632.7
214	45796	9800344	14.6287	5.9814	2.33041	4.67290	672.30	35968.1
215	46225	9938375	14.6629	5.9907	2.33244	4.65116	675.44	36305.0
216	46656	10077696	14.6969	6.0000	2.33445	4.62963	678.58	36643.5
217	47089	10218313	14.7309	6.0092	2.33646	4.60829	681.73	36983.6
218	47524	10360232	14.7648	6.0185	2.33846	4.58716	684.87	37325.3
219	47961	10503459	14.7986	6.0277	2.34044	4.56621	688.01	37668.5
220	48400	10648000	14.8324	6.0368	2.34242	4.54545	691.15	38013.3
221	48841	10793861	14.8661	6.0459	2.34439	4.52489	694.29	38359.6
222	49284	10941048	14.8997	6.0550	2.34635	4.50450	697.43	38707.6
223	49729	11089567	14.9332	6.0641	2.34830	4.48430	700.58	39057.1
224	50176	11239424	14.9666	6.0732	2.35025	4.46429	703.72	39408.1
225	50625	11390625	15.0000	6.0822	2.35218	4.44444	706.86	39760.8
226	51076	11543176	15.0333	6.0912	2.35411	4.42478	710.00	40115.0
227	51529	11697083	15.0665	6.1002	2.35603	4.40529	713.14	40470.8
228	51984	11852352	15.0997	6.1091	2.35793	4.38596	716.28	40828.1
229	52441	12008989	15.1327	6.1180	2.35984	4.36681	719.42	41187.1
230	52900	12167000	15.1658	6.1269	2.36173	4.34783	722.57	41547.6
231	53361	12326391	15.1987	6.1358	2.36361	4.32900	725.71	41909.6
232	53824	12487168	15.2315	6.1446	2.36549	4.31034	728.85	42273.3
233	54289	12649337	15.2643	6.1534	2.36736	4.29185	731.99	42638.5
234	54756	12812904	15.2971	6.1622	2.36922	4.27350	735.13	43005.3
235	55225	12977875	15.3297	6.1710	2.37107	4.25532	738.27	43373.6
236	55696	13144256	15.3623	6.1797	2.37291	4.23729	741.42	43743.5
237	56169	13312053	15.3948	6.1885	2.37475	4.21941	744.56	44115.0
238	56644	13481272	15.4272	6.1972	2.37658	4.20168	747.70	44488.1
239	57121	13651919	15.4596	6.2058	2.37840	4.18410	750.84	44862.7
240	57600	13824000	15.4919	6.2145	2.38021	4.16667	753.98	45238.9
241	58081	13997521	15.5242	6.2231	2.38202	4.14938	757.12	45616.7
242	58564	14172488	15.5563	6.2317	2.38382	4.13223	760.27	45996.1
243	59049	14348907	15.5885	6.2403	2.38561	4.11523	763.41	46377.0
244	59536	14526784	15.6205	6.2488	2.38739	4.09836	766.55	46759.5
245	60025	14706125	15.6525	6.2573	2.38917	4.08163	769.69	47143.5
246	60516	14886936	15.6844	6.2658	2.39094	4.06504	772.83	47529.2
247	61009	15069223	15.7162	6.2743	2.39270	4.04858	775.97	47916.4
248	61504	15252992	15.7480	6.2828	2.39445	4.03226	779.12	48305.1
249	62001	15438249	15.7797	6.2912	2.39620	4.01606	782.26	48695.5

Functions of Numbers, 250 to 299

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter	
							Circum.	Area
250	62500	15625000	15.8114	6.2996	2.39794	4.00000	785.40	49087.4
251	63001	15813251	15.8430	6.3080	2.39967	3.98406	788.54	49480.9
252	63504	16003008	15.8745	6.3164	2.40140	3.96825	791.68	49875.9
253	64009	16194277	15.9060	6.3247	2.40312	3.95257	794.82	50272.6
254	64516	16387064	15.9374	6.3330	2.40483	3.93701	797.96	50670.7
255	65025	16581375	15.9687	6.3413	2.40654	3.92157	801.11	51070.5
256	65536	16777216	16.0000	6.3496	2.40824	3.90625	804.25	51471.9
257	66049	16974593	16.0312	6.3579	2.40993	3.89105	807.39	51874.8
258	66564	17173512	16.0624	6.3661	2.41162	3.87597	810.53	52279.2
259	67081	17373979	16.0935	6.3743	2.41330	3.86100	813.67	52685.3
260	67600	17576000	16.1245	6.3825	2.41497	3.84615	816.81	53092.9
261	68121	17779581	16.1555	6.3907	2.41664	3.83142	819.96	53502.1
262	68644	17984728	16.1864	6.3988	2.41830	3.81679	823.10	53912.9
263	69169	18191447	16.2173	6.4070	2.41996	3.80228	826.24	54325.2
264	69696	18399744	16.2481	6.4151	2.42160	3.78788	829.38	54739.1
265	70225	18609625	16.2788	6.4232	2.42325	3.77358	832.52	55154.6
266	70756	18821096	16.3095	6.4312	2.42488	3.75940	835.66	55571.6
267	71289	19034163	16.3401	6.4393	2.42651	3.74532	838.81	55990.2
268	71824	19248832	16.3707	6.4473	2.42813	3.73134	841.95	56410.4
269	72361	19465109	16.4012	6.4553	2.42975	3.71747	845.09	56832.2
270	72900	19683000	16.4317	6.4633	2.43136	3.70370	848.23	57255.5
271	73441	19902511	16.4621	6.4713	2.43297	3.69004	851.37	57680.4
272	73984	20123648	16.4924	6.4792	2.43457	3.67647	854.51	58106.9
273	74529	20346417	16.5227	6.4872	2.43616	3.66300	857.65	58534.9
274	75076	20570824	16.5529	6.4951	2.43775	3.64964	860.80	58964.6
275	75625	20796875	16.5831	6.5030	2.43933	3.63636	863.94	59395.7
276	76176	21024576	16.6132	6.5108	2.44091	3.62319	867.08	59828.5
277	76729	21253933	16.6433	6.5187	2.44248	3.61011	870.22	60262.8
278	77284	21484952	16.6733	6.5265	2.44404	3.59712	873.36	60698.7
279	77841	21717639	16.7033	6.5343	2.44560	3.58423	876.50	61136.2
280	78400	21952000	16.7332	6.5421	2.44716	3.57143	879.65	61575.2
281	78961	22188041	16.7631	6.5499	2.44871	3.55872	882.79	62015.8
282	79524	22425768	16.7929	6.5577	2.45025	3.54610	885.93	62458.0
283	80089	22665187	16.8226	6.5654	2.45179	3.53357	889.07	62901.8
284	80656	22906304	16.8523	6.5731	2.45332	3.52113	892.21	63347.1
285	81225	23149125	16.8819	6.5808	2.45484	3.50877	895.35	63794.0
286	81796	23393656	16.9115	6.5885	2.45637	3.49650	898.50	64242.4
287	82369	23639903	16.9411	6.5962	2.45788	3.48432	901.64	64692.5
288	82944	23887872	16.9706	6.6039	2.45939	3.47222	904.78	65144.1
289	83521	24137569	17.0000	6.6115	2.46090	3.46021	907.92	65597.2
290	84100	24389000	17.0294	6.6191	2.46240	3.44828	911.06	66052.0
291	84681	24642171	17.0587	6.6267	2.46389	3.43643	914.20	66508.3
292	85264	24897088	17.0880	6.6343	2.46538	3.42466	917.35	66966.2
293	85849	25153757	17.1172	6.6419	2.46687	3.41297	920.49	67425.6
294	86436	25412184	17.1464	6.6494	2.46835	3.40136	923.63	67886.7
295	87025	25672375	17.1756	6.6569	2.46982	3.38983	926.77	68349.3
296	87616	25934336	17.2047	6.6644	2.47129	3.37838	929.91	68813.4
297	88209	26198073	17.2337	6.6719	2.47276	3.36700	933.05	69279.2
298	88804	26463592	17.2627	6.6794	2.47422	3.35570	936.19	69746.5
299	89401	26730899	17.2916	6.6869	2.47567	3.34448	939.34	70215.4

Functions of Numbers, 300 to 349

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter	
							Circum.	Area
300	90000	27000000	17.3205	6.6943	2.47712	3.33333	942.48	70685.8
301	90601	27270901	17.3494	6.7018	2.47857	3.32226	945.62	71157.9
302	91204	27543608	17.3781	6.7092	2.48001	3.31126	948.76	71631.5
303	91809	27818127	17.4069	6.7166	2.48144	3.30033	951.90	72106.6
304	92416	28094464	17.4356	6.7240	2.48287	3.28947	955.04	72583.4
305	93025	28372625	17.4642	6.7313	2.48430	3.27869	958.19	73061.7
306	93636	28652616	17.4929	6.7387	2.48572	3.26797	961.33	73541.5
307	94249	28934443	17.5214	6.7460	2.48714	3.25733	964.47	74023.0
308	94864	29218112	17.5499	6.7533	2.48855	3.24675	967.61	74506.0
309	95481	29503629	17.5784	6.7606	2.48996	3.23625	970.75	74990.6
310	96100	29791000	17.6068	6.7679	2.49136	3.22581	973.89	75476.8
311	96721	30080231	17.6352	6.7752	2.49276	3.21543	977.04	75964.5
312	97344	30371328	17.6635	6.7824	2.49415	3.20513	980.18	76453.8
313	97969	30664297	17.6918	6.7897	2.49554	3.19489	983.32	76944.7
314	98596	30959144	17.7200	6.7969	2.49693	3.18471	986.46	77437.1
315	99225	31255875	17.7482	6.8041	2.49831	3.17460	989.60	77931.1
316	99856	31554496	17.7764	6.8113	2.49969	3.16456	992.74	78426.7
317	100489	31855013	17.8045	6.8185	2.50106	3.15457	995.88	78923.9
318	101124	32157432	17.8326	6.8256	2.50243	3.14465	999.03	79422.6
319	101761	32461759	17.8606	6.8328	2.50379	3.13480	1002.2	79922.9
320	102400	32768000	17.8885	6.8399	2.50515	3.12500	1005.3	80424.8
321	103041	33076161	17.9165	6.8470	2.50651	3.11526	1008.5	80928.2
322	103684	33386248	17.9444	6.8541	2.50786	3.10559	1011.6	81433.2
323	104329	33698267	17.9722	6.8612	2.50920	3.09598	1014.7	81939.8
324	104976	34012224	18.0000	6.8683	2.51055	3.08642	1017.9	82448.0
325	105625	34328125	18.0278	6.8753	2.51188	3.07692	1021.0	82957.7
326	106276	34645976	18.0555	6.8824	2.51322	3.06749	1024.2	83469.0
327	106929	34965783	18.0831	6.8894	2.51455	3.05810	1027.3	83981.8
328	107584	35287552	18.1108	6.8964	2.51587	3.04878	1030.4	84496.3
329	108241	35611289	18.1384	6.9034	2.51720	3.03951	1033.6	85012.3
330	108900	35937000	18.1659	6.9104	2.51851	3.03030	1036.7	85529.9
331	109561	36264691	18.1934	6.9174	2.51983	3.02115	1039.9	86049.0
332	110224	36594368	18.2209	6.9244	2.52114	3.01205	1043.0	86569.7
333	110889	36926037	18.2483	6.9313	2.52244	3.00300	1046.2	87092.0
334	111556	37259704	18.2757	6.9382	2.52375	2.99401	1049.3	87615.9
335	112225	37595375	18.3030	6.9451	2.52504	2.98507	1052.4	88141.3
336	112896	37933056	18.3303	6.9521	2.52634	2.97619	1055.6	88668.3
337	113569	38272753	18.3576	6.9589	2.52763	2.96736	1058.7	89196.9
338	114244	38614472	18.3848	6.9658	2.52892	2.95858	1061.9	89727.0
339	114921	38958219	18.4120	6.9727	2.53020	2.94985	1065.0	90258.7
340	115600	39304000	18.4391	6.9795	2.53148	2.94118	1068.1	90792.0
341	116281	39651821	18.4662	6.9864	2.53275	2.93255	1071.3	91326.9
342	116964	40001688	18.4932	6.9932	2.53403	2.92398	1074.4	91863.3
343	117649	40353607	18.5203	7.0000	2.53529	2.91545	1077.6	92401.3
344	118336	40707584	18.5472	7.0068	2.53656	2.90698	1080.7	92940.9
345	119025	41063625	18.5742	7.0136	2.53782	2.89855	1083.8	93482.0
346	119716	41421736	18.6011	7.0203	2.53908	2.89017	1087.0	94024.7
347	120409	41781923	18.6279	7.0271	2.54033	2.88184	1090.1	94569.0
348	121104	42144192	18.6548	7.0338	2.54158	2.87356	1093.3	95114.9
349	121801	42508549	18.6815	7.0405	2.54283	2.86533	1096.4	95662.3

Functions of Numbers, 350 to 399

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter	
							Circum.	Area
350	122500	42875000	18.7083	7.0473	2.54407	2.85714	1099.6	96211.3
351	123201	43243551	18.7350	7.0540	2.54531	2.84900	1102.7	96761.8
352	123904	43614208	18.7617	7.0607	2.54654	2.84091	1105.8	97314.0
353	124609	43986977	18.7883	7.0674	2.54777	2.83286	1109.0	97867.7
354	125316	44361864	18.8149	7.0740	2.54900	2.82486	1112.1	98423.0
355	126025	44738875	18.8414	7.0807	2.55023	2.81690	1115.3	98979.8
356	126736	45118016	18.8680	7.0873	2.55145	2.80899	1118.4	99538.2
357	127449	45499293	18.8944	7.0940	2.55267	2.80112	1121.5	100098
358	128164	45882712	18.9209	7.1006	2.55388	2.79330	1124.7	100660
359	128881	46268279	18.9473	7.1072	2.55509	2.78552	1127.8	101223
360	129600	46656000	18.9737	7.1138	2.55630	2.77778	1131.0	101788
361	130321	47045881	19.0000	7.1204	2.55751	2.77008	1134.1	102354
362	131044	47437928	19.0263	7.1269	2.55871	2.76243	1137.3	102922
363	131769	47832147	19.0526	7.1335	2.55991	2.75482	1140.4	103491
364	132496	48228544	19.0788	7.1400	2.56110	2.74725	1143.5	104062
365	133225	48627125	19.1050	7.1466	2.56229	2.73973	1146.7	104635
366	133956	49027896	19.1311	7.1531	2.56348	2.73224	1149.8	105209
367	134689	49430863	19.1572	7.1596	2.56467	2.72480	1153.0	105785
368	135424	49836032	19.1833	7.1661	2.56585	2.71739	1156.1	106362
369	136161	50243409	19.2094	7.1726	2.56703	2.71003	1159.2	106941
370	136900	50653000	19.2354	7.1791	2.56820	2.70270	1162.4	107521
371	137641	51064811	19.2614	7.1855	2.56937	2.69542	1165.5	108103
372	138384	51478848	19.2873	7.1920	2.57054	2.68817	1168.7	108687
373	139129	51895117	19.3132	7.1984	2.57171	2.68097	1171.8	109272
374	139876	52313624	19.3391	7.2048	2.57287	2.67380	1175.0	109858
375	140625	52734375	19.3649	7.2112	2.57403	2.66667	1178.1	110447
376	141376	53157376	19.3907	7.2177	2.57519	2.65957	1181.2	111036
377	142129	53582633	19.4165	7.2240	2.57634	2.65252	1184.4	111628
378	142884	54010152	19.4422	7.2304	2.57749	2.64550	1187.5	112221
379	143641	54439939	19.4679	7.2368	2.57864	2.63852	1190.7	112815
380	144400	54872000	19.4936	7.2432	2.57978	2.63158	1193.8	113411
381	145161	55306341	19.5192	7.2495	2.58093	2.62467	1196.9	114009
382	145924	55742968	19.5448	7.2558	2.58206	2.61780	1200.1	114608
383	146689	56181887	19.5704	7.2622	2.58320	2.61097	1203.2	115209
384	147456	56623104	19.5959	7.2685	2.58433	2.60417	1206.4	115812
385	148225	57066625	19.6214	7.2748	2.58546	2.59740	1209.5	116416
386	148996	57512456	19.6469	7.2811	2.58659	2.59067	1212.7	117021
387	149769	57960603	19.6723	7.2874	2.58771	2.58398	1215.8	117628
388	150544	58411072	19.6977	7.2936	2.58883	2.57732	1218.9	118237
389	151321	58863869	19.7231	7.2999	2.58995	2.57069	1222.1	118847
390	152100	59319000	19.7484	7.3061	2.59106	2.56410	1225.2	119459
391	152881	59776471	19.7737	7.3124	2.59218	2.55754	1228.4	120072
392	153664	60236288	19.7990	7.3186	2.59329	2.55102	1231.5	120687
393	154449	60698457	19.8242	7.3248	2.59439	2.54453	1234.6	121304
394	155236	61162984	19.8494	7.3310	2.59550	2.53807	1237.8	121922
395	156025	61629875	19.8746	7.3372	2.59660	2.53165	1240.9	122542
396	156816	62099136	19.8997	7.3434	2.59770	2.52525	1244.1	123163
397	157609	62570773	19.9249	7.3496	2.59879	2.51889	1247.2	123786
398	158404	63044792	19.9499	7.3558	2.59988	2.51256	1250.4	124410
399	159201	63521199	19.9750	7.3619	2.60097	2.50627	1253.5	125036

Functions of Numbers 400 to 449

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter	
							Circum.	Area
400	160000	64000000	20.0000	7.3681	2.60206	2.50000	1256.6	125664
401	160801	64481201	20.0250	7.3742	2.60314	2.49377	1259.8	126293
402	161604	64964808	20.0499	7.3803	2.60423	2.48756	1262.9	126923
403	162409	65450827	20.0749	7.3864	2.60531	2.48139	1266.1	127556
404	163216	65939264	20.0998	7.3925	2.60638	2.47525	1269.2	128190
405	164025	66430125	20.1246	7.3986	2.60746	2.46914	1272.3	128825
406	164836	66923416	20.1494	7.4047	2.60853	2.46305	1275.5	129462
407	165649	67419143	20.1742	7.4108	2.60959	2.45700	1278.6	130100
408	166464	67917312	20.1990	7.4169	2.61066	2.45098	1281.8	130741
409	167281	68417929	20.2237	7.4229	2.61172	2.44499	1284.9	131382
410	168100	68921000	20.2485	7.4290	2.61278	2.43902	1288.1	132025
411	168921	69426531	20.2731	7.4350	2.61384	2.43309	1291.2	132670
412	169744	69934528	20.2978	7.4410	2.61490	2.42718	1294.3	133317
413	170569	70444997	20.3224	7.4470	2.61595	2.42131	1297.5	133965
414	171396	70957944	20.3470	7.4530	2.61700	2.41546	1300.6	134614
415	172225	71473375	20.3715	7.4590	2.61805	2.40964	1303.8	135265
416	173056	71991296	20.3961	7.4650	2.61909	2.40385	1306.9	135918
417	173889	72511713	20.4206	7.4710	2.62014	2.39808	1310.0	136572
418	174724	73034632	20.4450	7.4770	2.62118	2.39234	1313.2	137228
419	175561	73560059	20.4695	7.4829	2.62221	2.38663	1316.3	137885
420	176400	74088000	20.4939	7.4889	2.62325	2.38095	1319.5	138544
421	177241	74618461	20.5183	7.4948	2.62428	2.37530	1322.6	139205
422	178084	75151448	20.5426	7.5007	2.62531	2.36967	1325.8	139867
423	178929	75686967	20.5670	7.5067	2.62634	2.36407	1328.9	140531
424	179776	76225024	20.5913	7.5126	2.62737	2.35849	1332.0	141196
425	180625	76765625	20.6155	7.5185	2.62839	2.35294	1335.2	141863
426	181476	77308776	20.6398	7.5244	2.62941	2.34742	1338.3	142531
427	182329	77854483	20.6640	7.5302	2.63043	2.34192	1341.5	143201
428	183184	78402752	20.6882	7.5361	2.63144	2.33645	1344.6	143872
429	184041	78953589	20.7123	7.5420	2.63246	2.33100	1347.7	144545
430	184900	79507000	20.7364	7.5478	2.63347	2.32558	1350.9	145220
431	185761	80062991	20.7605	7.5537	2.63448	2.32019	1354.0	145896
432	186624	80621568	20.7846	7.5595	2.63548	2.31481	1357.2	146574
433	187489	81182737	20.8087	7.5654	2.63649	2.30947	1360.3	147254
434	188356	81746504	20.8327	7.5712	2.63749	2.30415	1363.5	147934
435	189225	82312875	20.8567	7.5770	2.63849	2.29885	1366.6	148617
436	190096	82881856	20.8806	7.5828	2.63949	2.29358	1369.7	149301
437	190969	83453453	20.9045	7.5886	2.64048	2.28833	1372.9	149987
438	191844	84027672	20.9284	7.5944	2.64147	2.28311	1376.0	150674
439	192721	84604519	20.9523	7.6001	2.64246	2.27790	1379.2	151363
440	193600	85184000	20.9762	7.6059	2.64345	2.27273	1382.3	152053
441	194481	85766121	21.0000	7.6117	2.64444	2.26757	1385.4	152745
442	195364	86350888	21.0238	7.6174	2.64542	2.26244	1388.6	153439
443	196249	86938307	21.0476	7.6232	2.64640	2.25734	1391.7	154134
444	197136	87528384	21.0713	7.6289	2.64738	2.25225	1394.9	154830
445	198025	88121125	21.0950	7.6346	2.64836	2.24719	1398.0	155528
446	198916	88716536	21.1187	7.6403	2.64933	2.24215	1401.2	156228
447	199809	89314623	21.1424	7.6460	2.65031	2.23714	1404.3	156930
448	200704	89915392	21.1660	7.6517	2.65128	2.23214	1407.4	157633
449	201601	90518849	21.1896	7.6574	2.65225	2.22717	1410.6	158337

Functions of Numbers, 450 to 499

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter	
							Circum.	Area
450	202500	91125000	21.2132	7.6631	2.65321	2.22222	1413.7	159043
451	203401	91733851	21.2368	7.6688	2.65418	2.21729	1416.9	159751
452	204304	92345408	21.2603	7.6744	2.65514	2.21239	1420.0	160460
453	205209	92959677	21.2838	7.6801	2.65610	2.20751	1423.1	161171
454	206116	93576664	21.3073	7.6857	2.65706	2.20264	1426.3	161883
455	207025	94196375	21.3307	7.6914	2.65801	2.19780	1429.4	162597
456	207936	94818816	21.3542	7.6970	2.65896	2.19298	1432.6	163313
457	208849	95443993	21.3776	7.7026	2.65992	2.18818	1435.7	164030
458	209764	96071912	21.4009	7.7082	2.66087	2.18341	1438.8	164748
459	210681	96702579	21.4243	7.7138	2.66181	2.17865	1442.0	165468
460	211600	97336000	21.4476	7.7194	2.66276	2.17391	1445.1	166190
461	212521	97972181	21.4709	7.7250	2.66370	2.16920	1448.3	166914
462	213444	98611128	21.4942	7.7306	2.66464	2.16450	1451.4	167639
463	214369	99252847	21.5174	7.7362	2.66558	2.15983	1454.6	168365
464	215296	99897344	21.5407	7.7418	2.66652	2.15517	1457.7	169093
465	216225	100544625	21.5639	7.7473	2.66745	2.15054	1460.8	169823
466	217156	101194696	21.5870	7.7529	2.66839	2.14592	1464.0	170554
467	218089	101847563	21.6102	7.7584	2.66932	2.14133	1467.1	171287
468	219024	102503232	21.6333	7.7639	2.67025	2.13675	1470.3	172021
469	219961	103161709	21.6564	7.7695	2.67117	2.13220	1473.4	172757
470	220900	103823000	21.6795	7.7750	2.67210	2.12766	1476.5	173494
471	221841	104487111	21.7025	7.7805	2.67302	2.12314	1479.7	174234
472	222784	105154048	21.7256	7.7860	2.67394	2.11864	1482.8	174974
473	223729	105823817	21.7486	7.7915	2.67486	2.11416	1486.0	175716
474	224676	106496424	21.7715	7.7970	2.67578	2.10970	1489.1	176460
475	225625	107171875	21.7945	7.8025	2.67669	2.10526	1492.3	177205
476	226576	107850176	21.8174	7.8079	2.67761	2.10084	1495.4	177952
477	227529	108531333	21.8403	7.8134	2.67852	2.09644	1498.5	178701
478	228484	109215352	21.8632	7.8188	2.67943	2.09205	1501.7	179451
479	229441	109902239	21.8861	7.8243	2.68034	2.08768	1504.8	180203
480	230400	110592000	21.9089	7.8297	2.68124	2.08333	1508.0	180956
481	231361	111284641	21.9317	7.8352	2.68215	2.07900	1511.1	181711
482	232324	111980168	21.9545	7.8406	2.68305	2.07469	1514.2	182467
483	233289	112678587	21.9773	7.8460	2.68395	2.07039	1517.4	183225
484	234256	113379904	22.0000	7.8514	2.68485	2.06612	1520.5	183984
485	235225	114084125	22.0227	7.8568	2.68574	2.06186	1523.7	184745
486	236196	114791256	22.0454	7.8622	2.68664	2.05761	1526.8	185508
487	237169	115501303	22.0681	7.8676	2.68753	2.05339	1530.0	186272
488	238144	116214272	22.0907	7.8730	2.68842	2.04918	1533.1	187038
489	239121	116930169	22.1133	7.8784	2.68931	2.04499	1536.2	187805
490	240100	117649000	22.1359	7.8837	2.69020	2.04082	1539.4	188574
491	241081	118370771	22.1585	7.8891	2.69108	2.03666	1542.5	189345
492	242064	119095488	22.1811	7.8944	2.69197	2.03252	1545.7	190117
493	243049	119823157	22.2036	7.8998	2.69285	2.02840	1548.8	190890
494	244036	120553784	22.2261	7.9051	2.69373	2.02429	1551.9	191665
495	245025	121287375	22.2486	7.9105	2.69461	2.02020	1555.1	192442
496	246016	122023936	22.2711	7.9158	2.69548	2.01613	1558.2	193221
497	247009	122763473	22.2935	7.9211	2.69636	2.01207	1561.4	194000
498	248004	123505992	22.3159	7.9264	2.69723	2.00803	1564.5	194782
499	249001	124251499	22.3383	7.9317	2.69810	2.00401	1567.7	195565

Functions of Numbers 500 to 549

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No. = Diameter	
							Circum.	Area
500	250000	125000000	22.3607	7.9370	2.69897	2.00000	1570.8	196350
501	251001	125751501	22.3830	7.9423	2.69984	1.99601	1573.9	197136
502	252004	126506008	22.4054	7.9476	2.70070	1.99203	1577.1	197923
503	253009	127263527	22.4277	7.9528	2.70157	1.98807	1580.2	198713
504	254016	128024064	22.4499	7.9581	2.70243	1.98413	1583.4	199504
505	255025	128787625	22.4722	7.9634	2.70329	1.98020	1586.5	200296
506	256036	129554216	22.4944	7.9686	2.70415	1.97628	1589.6	201090
507	257049	130323843	22.5167	7.9739	2.70501	1.97239	1592.8	201886
508	258064	131096512	22.5389	7.9791	2.70586	1.96850	1595.9	202683
509	259081	131872229	22.5610	7.9843	2.70672	1.96464	1599.1	203482
510	260100	132651000	22.5832	7.9896	2.70757	1.96078	1602.2	204282
511	261121	133432831	22.6053	7.9948	2.70842	1.95695	1605.4	205084
512	262144	134217728	22.6274	8.0000	2.70927	1.95312	1608.5	205887
513	263169	135005697	22.6495	8.0052	2.71012	1.94932	1611.6	206692
514	264196	135796744	22.6716	8.0104	2.71096	1.94553	1614.8	207499
515	265225	136590875	22.6936	8.0156	2.71181	1.94175	1617.9	208307
516	266256	137388096	22.7156	8.0208	2.71265	1.93798	1621.1	209117
517	267289	138188413	22.7376	8.0260	2.71349	1.93424	1624.2	209928
518	268324	138991832	22.7596	8.0311	2.71433	1.93050	1627.3	210741
519	269361	139798359	22.7816	8.0363	2.71517	1.92678	1630.5	211556
520	270400	140608000	22.8035	8.0415	2.71600	1.92308	1633.6	212372
521	271441	141420761	22.8254	8.0466	2.71684	1.91939	1636.8	213189
522	272484	142236648	22.8473	8.0517	2.71767	1.91571	1639.9	214008
523	273529	143055667	22.8692	8.0569	2.71850	1.91205	1643.1	214829
524	274576	143877824	22.8910	8.0620	2.71933	1.90840	1646.2	215651
525	275625	144703125	22.9129	8.0671	2.72016	1.90476	1649.3	216475
526	276676	145531576	22.9347	8.0723	2.72099	1.90114	1652.5	217301
527	277729	146363183	22.9565	8.0774	2.72181	1.89753	1655.6	218128
528	278784	147197952	22.9783	8.0825	2.72263	1.89394	1658.8	218956
529	279841	148035889	23.0000	8.0876	2.72346	1.89036	1661.9	219787
530	280900	148877000	23.0217	8.0927	2.72428	1.88679	1665.0	220618
531	281961	149721291	23.0434	8.0978	2.72509	1.88324	1668.2	221452
532	283024	150568768	23.0651	8.1028	2.72591	1.87970	1671.3	222287
533	284089	151419437	23.0868	8.1079	2.72673	1.87617	1674.5	223123
534	285156	152273304	23.1084	8.1130	2.72754	1.87266	1677.6	223961
535	286225	153130375	23.1301	8.1180	2.72835	1.86916	1680.8	224801
536	287296	153990656	23.1517	8.1231	2.72916	1.86567	1683.9	225642
537	288369	154854153	23.1733	8.1281	2.72997	1.86220	1687.0	226484
538	289444	155720872	23.1948	8.1332	2.73078	1.85874	1690.2	227329
539	290521	156590819	23.2164	8.1382	2.73159	1.85529	1693.3	228175
540	291600	157464000	23.2379	8.1433	2.73239	1.85185	1696.5	229022
541	292681	158340421	23.2594	8.1483	2.73320	1.84843	1699.6	229871
542	293764	159220088	23.2809	8.1533	2.73400	1.84502	1702.7	230722
543	294849	160103007	23.3024	8.1583	2.73480	1.84162	1705.9	231574
544	295936	160989184	23.3238	8.1633	2.73560	1.83824	1709.0	232428
545	297025	161878625	23.3452	8.1683	2.73640	1.83486	1712.2	233283
546	298116	162771336	23.3666	8.1733	2.73719	1.83150	1715.3	234140
547	299209	163667323	23.3880	8.1783	2.73799	1.82815	1718.5	234998
548	300304	164566592	23.4094	8.1833	2.73878	1.82482	1721.6	235858
549	301401	165469149	23.4307	8.1882	2.73957	1.82149	1724.7	236720

Functions of Numbers, 550 to 599

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter	
							Circum.	Area
550	302500	166375000	23.4521	8.1932	2.74036	1.81818	1727.9	237583
551	303601	167284151	23.4734	8.1982	2.74115	1.81488	1731.0	238448
552	304704	168196608	23.4947	8.2031	2.74194	1.81159	1734.2	239314
553	305809	169112377	23.5160	8.2081	2.74273	1.80832	1737.3	240182
554	306916	170031464	23.5372	8.2130	2.74351	1.80505	1740.4	241051
555	308025	170953875	23.5584	8.2180	2.74429	1.80180	1743.6	241922
556	309136	171879616	23.5797	8.2229	2.74507	1.79856	1746.7	242795
557	310249	172808693	23.6008	8.2278	2.74586	1.79533	1749.9	243669
558	311364	173741112	23.6220	8.2327	2.74663	1.79211	1753.0	244545
559	312481	174676879	23.6432	8.2377	2.74741	1.78891	1756.2	245422
560	313600	175616000	23.6643	8.2426	2.74819	1.78571	1759.3	246301
561	314721	176558481	23.6854	8.2475	2.74896	1.78253	1762.4	247181
562	315844	177504328	23.7065	8.2524	2.74974	1.77936	1765.6	248063
563	316969	178453547	23.7276	8.2573	2.75051	1.77620	1768.7	248947
564	318096	179406144	23.7487	8.2621	2.75128	1.77305	1771.9	249832
565	319225	180362125	23.7697	8.2670	2.75205	1.76991	1775.0	250719
566	320356	181321496	23.7908	8.2719	2.75282	1.76678	1778.1	251607
567	321489	182284263	23.8118	8.2768	2.75358	1.76367	1781.3	252497
568	322624	183250432	23.8328	8.2816	2.75435	1.76056	1784.4	253388
569	323761	184220009	23.8537	8.2865	2.75511	1.75747	1787.6	254281
570	324900	185193000	23.8747	8.2913	2.75587	1.75439	1790.7	255176
571	326041	186169411	23.8956	8.2962	2.75664	1.75131	1793.8	256072
572	327184	187149248	23.9165	8.3010	2.75740	1.74825	1797.0	256970
573	328329	188132517	23.9374	8.3059	2.75815	1.74520	1800.1	257869
574	329476	189119224	23.9583	8.3107	2.75891	1.74216	1803.3	258770
575	330625	190109375	23.9792	8.3155	2.75967	1.73913	1806.4	259672
576	331776	191102976	24.0000	8.3203	2.76042	1.73611	1809.6	260576
577	332929	192100033	24.0208	8.3251	2.76118	1.73310	1812.7	261482
578	334084	193100552	24.0416	8.3300	2.76193	1.73010	1815.8	262389
579	335241	194104539	24.0624	8.3348	2.76268	1.72712	1819.0	263298
580	336400	195112000	24.0832	8.3396	2.76343	1.72414	1822.1	264208
581	337561	196122941	24.1039	8.3443	2.76418	1.72117	1825.3	265120
582	338724	197137368	24.1247	8.3491	2.76492	1.71821	1828.4	266033
583	339889	198155287	24.1454	8.3539	2.76567	1.71527	1831.6	266948
584	341056	199176704	24.1661	8.3587	2.76641	1.71233	1834.7	267865
585	342225	200201625	24.1868	8.3634	2.76716	1.70940	1837.8	268783
586	343396	201230056	24.2074	8.3682	2.76790	1.70648	1841.0	269703
587	344569	202262003	24.2281	8.3730	2.76864	1.70358	1844.1	270624
588	345744	203297472	24.2487	8.3777	2.76938	1.70068	1847.3	271547
589	346921	204336469	24.2693	8.3825	2.77012	1.69779	1850.4	272471
590	348100	205379000	24.2899	8.3872	2.77085	1.69492	1853.5	273397
591	349281	206425071	24.3105	8.3919	2.77159	1.69205	1856.7	274325
592	350464	207474688	24.3311	8.3967	2.77232	1.68919	1859.8	275254
593	351649	208527857	24.3516	8.4014	2.77305	1.68634	1863.0	276184
594	352836	209584584	24.3721	8.4061	2.77379	1.68350	1866.1	277117
595	354025	210644875	24.3926	8.4108	2.77452	1.68067	1869.2	278051
596	355216	211708736	24.4131	8.4155	2.77525	1.67785	1872.4	278986
597	356409	212776173	24.4336	8.4202	2.77597	1.67504	1875.5	279923
598	357604	213847192	24.4540	8.4249	2.77670	1.67224	1878.7	280862
599	358801	214921799	24.4745	8.4296	2.77743	1.66945	1881.8	281802

Functions of Numbers 600 to 649

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter	
							Circum.	Area
600	360000	216000000	24.4949	8.4343	2.77815	1.66667	1885.0	282743
601	361201	217081801	24.5153	8.4390	2.77887	1.66389	1888.1	283687
602	362404	218167208	24.5357	8.4437	2.77960	1.66113	1891.2	284631
603	363609	219256227	24.5561	8.4484	2.78032	1.65837	1894.4	285578
604	364816	220348864	24.5764	8.4530	2.78104	1.65563	1897.5	286526
605	366025	221445125	24.5967	8.4577	2.78176	1.65289	1900.7	287475
606	367236	222545016	24.6171	8.4623	2.78247	1.65017	1903.8	288426
607	368449	223648543	24.6374	8.4670	2.78319	1.64745	1906.9	289379
608	369664	224755712	24.6577	8.4716	2.78390	1.64474	1910.1	290333
609	370881	225866529	24.6779	8.4763	2.78462	1.64204	1913.2	291289
610	372100	226981000	24.6982	8.4809	2.78533	1.63934	1916.4	292247
611	373321	228099131	24.7184	8.4856	2.78604	1.63666	1919.5	293206
612	374544	229220928	24.7386	8.4902	2.78675	1.63399	1922.7	294166
613	375769	230346397	24.7588	8.4948	2.78746	1.63132	1925.8	295128
614	376996	231475544	24.7790	8.4994	2.78817	1.62866	1928.9	296092
615	378225	232608375	24.7992	8.5040	2.78888	1.62602	1932.1	297057
616	379456	233744896	24.8193	8.5086	2.78958	1.62338	1935.2	298024
617	380689	234885113	24.8395	8.5132	2.79029	1.62075	1938.4	298992
618	381924	236029032	24.8596	8.5178	2.79099	1.61812	1941.5	299962
619	383161	237176659	24.8797	8.5224	2.79169	1.61551	1944.6	300934
620	384400	238328000	24.8998	8.5270	2.79239	1.61290	1947.8	301907
621	385641	239483061	24.9199	8.5316	2.79309	1.61031	1950.9	302882
622	386884	240641848	24.9399	8.5362	2.79379	1.60772	1954.1	303858
623	388129	241804367	24.9600	8.5408	2.79449	1.60514	1957.2	304836
624	389376	242970624	24.9800	8.5453	2.79518	1.60256	1960.4	305815
625	390625	244140625	25.0000	8.5499	2.79588	1.60000	1963.5	306796
626	391876	245314376	25.0200	8.5544	2.79657	1.59744	1966.6	307779
627	393129	246491883	25.0400	8.5590	2.79727	1.59490	1969.8	308763
628	394384	247673152	25.0599	8.5635	2.79796	1.59236	1972.9	309748
629	395641	248858189	25.0799	8.5681	2.79865	1.58983	1976.1	310736
630	396900	250047000	25.0998	8.5726	2.79934	1.58730	1979.2	311725
631	398161	251239591	25.1197	8.5772	2.80003	1.58479	1982.3	312715
632	399424	252435968	25.1396	8.5817	2.80072	1.58228	1985.5	313707
633	400689	253636137	25.1595	8.5862	2.80140	1.57978	1988.6	314700
634	401956	254840104	25.1794	8.5907	2.80209	1.57729	1991.8	315696
635	403225	256047875	25.1992	8.5952	2.80277	1.57480	1994.9	316692
636	404496	257259456	25.2190	8.5997	2.80346	1.57233	1998.1	317690
637	405769	258474853	25.2389	8.6043	2.80414	1.56986	2001.2	318690
638	407044	259694072	25.2587	8.6088	2.80482	1.56740	2004.3	319692
639	408321	260917119	25.2784	8.6132	2.80550	1.56495	2007.5	320695
640	409600	262144000	25.2982	8.6177	2.80618	1.56250	2010.6	321699
641	410881	263374721	25.3180	8.6222	2.80686	1.56006	2013.8	322705
642	412164	264609288	25.3377	8.6267	2.80754	1.55763	2016.9	323713
643	413449	265847707	25.3574	8.6312	2.80821	1.55521	2020.0	324722
644	414736	267089984	25.3772	8.6357	2.80889	1.55280	2023.2	325733
645	416025	268336125	25.3969	8.6401	2.80956	1.55039	2026.3	326745
646	417316	269586136	25.4165	8.6446	2.81023	1.54799	2029.5	327759
647	418609	270840023	25.4362	8.6490	2.81090	1.54560	2032.6	328775
648	419904	272097792	25.4558	8.6535	2.81158	1.54321	2035.8	329792
649	421201	273359449	25.4755	8.6579	2.81224	1.54083	2038.9	330810

Functions of Numbers, 650 to 699

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter Circum.	Area
650	422500	274625000	25.4951	8.6624	2.81291	1.53846	2042.0	331831
651	423801	275894451	25.5147	8.6668	2.81358	1.53610	2045.2	332853
652	425104	277167808	25.5343	8.6713	2.81425	1.53374	2048.3	333876
653	426409	278445077	25.5539	8.6757	2.81491	1.53139	2051.5	334901
654	427716	279726264	25.5734	8.6801	2.81558	1.52905	2054.6	335927
655	429025	281011375	25.5930	8.6845	2.81624	1.52672	2057.7	336955
656	430336	282300416	25.6125	8.6890	2.81690	1.52439	2060.9	337985
657	431649	283593393	25.6320	8.6934	2.81757	1.52207	2064.0	339016
658	432964	284890312	25.6515	8.6978	2.81823	1.51976	2067.2	340049
659	434281	286191179	25.6710	8.7022	2.81889	1.51745	2070.3	341084
660	435600	287496000	25.6905	8.7066	2.81954	1.51515	2073.5	342119
661	436921	288804781	25.7099	8.7110	2.82020	1.51286	2076.6	343157
662	438244	290117528	25.7294	8.7154	2.82086	1.51057	2079.7	344196
663	439569	291434247	25.7488	8.7198	2.82151	1.50830	2082.9	345237
664	440896	292754944	25.7682	8.7241	2.82217	1.50602	2086.0	346279
665	442225	294079625	25.7876	8.7285	2.82282	1.50376	2089.2	347323
666	443556	295408296	25.8070	8.7329	2.82347	1.50150	2092.3	348368
667	444889	296740963	25.8263	8.7373	2.82413	1.49925	2095.4	349415
668	446224	298077632	25.8457	8.7416	2.82478	1.49701	2098.6	350464
669	447561	299418309	25.8650	8.7460	2.82543	1.49477	2101.7	351514
670	448900	300763000	25.8844	8.7503	2.82607	1.49254	2104.9	352565
671	450241	302111711	25.9037	8.7547	2.82672	1.49031	2108.0	353618
672	451584	303464448	25.9230	8.7590	2.82737	1.48810	2111.2	354673
673	452929	304821217	25.9422	8.7634	2.82802	1.48588	2114.3	355730
674	454276	306182024	25.9615	8.7677	2.82866	1.48368	2117.4	356788
675	455625	307546875	25.9808	8.7721	2.82930	1.48148	2120.6	357847
676	456976	308915776	26.0000	8.7764	2.82995	1.47929	2123.7	358908
677	458329	310288733	26.0192	8.7807	2.83059	1.47710	2126.9	359971
678	459684	311665752	26.0384	8.7850	2.83123	1.47493	2130.0	361035
679	461041	313046839	26.0576	8.7893	2.83187	1.47275	2133.1	362101
680	462400	314432000	26.0768	8.7937	2.83251	1.47059	2136.3	363168
681	463761	315821241	26.0960	8.7980	2.83315	1.46843	2139.4	364237
682	465124	317214568	26.1151	8.8023	2.83378	1.46628	2142.6	365308
683	466489	318611987	26.1343	8.8066	2.83442	1.46413	2145.7	366380
684	467856	320013504	26.1534	8.8109	2.83506	1.46199	2148.8	367453
685	469225	321419125	26.1725	8.8152	2.83569	1.45985	2152.0	368528
686	470596	322828856	26.1916	8.8194	2.83632	1.45773	2155.1	369605
687	471969	324242703	26.2107	8.8237	2.83696	1.45560	2158.3	370684
688	473344	325660672	26.2298	8.8280	2.83759	1.45349	2161.4	371764
689	474721	327082769	26.2488	8.8323	2.83822	1.45138	2164.6	372845
690	476100	328509000	26.2679	8.8366	2.83885	1.44928	2167.7	373928
691	477481	329939371	26.2869	8.8408	2.83948	1.44718	2170.8	375013
692	478864	331373888	26.3059	8.8451	2.84011	1.44509	2174.0	376099
693	480249	332812557	26.3249	8.8493	2.84073	1.44300	2177.1	377187
694	481636	334255384	26.3439	8.8536	2.84136	1.44092	2180.3	378276
695	483025	335702375	26.3629	8.8578	2.84198	1.43885	2183.4	379367
696	484416	337153536	26.3818	8.8621	2.84261	1.43678	2186.5	380459
697	485809	338608873	26.4008	8.8663	2.84323	1.43472	2189.7	381553
698	487204	340068392	26.4197	8.8706	2.84386	1.43266	2192.8	382649
699	488601	341532099	26.4386	8.8748	2.84448	1.43062	2196.0	383746

Functions of Numbers, 700 to 749

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter Circum.	Area
700	490000	343000000	26.4575	8.8790	2.84510	1.42857	2199.1	384845
701	491401	344472101	26.4764	8.8833	2.84572	1.42653	2202.3	385945
702	492804	345948408	26.4953	8.8875	2.84634	1.42450	2205.4	387047
703	494209	347428927	26.5141	8.8917	2.84696	1.42248	2208.5	388151
704	495616	348913664	26.5330	8.8959	2.84757	1.42045	2211.7	389256
705	497025	350402625	26.5518	8.9001	2.84819	1.41844	2214.8	390363
706	498436	351895816	26.5707	8.9043	2.84880	1.41643	2218.0	391471
707	499849	353393243	26.5895	8.9085	2.84942	1.41443	2221.1	392580
708	501264	354894912	26.6083	8.9127	2.85003	1.41243	2224.2	393692
709	502681	356400829	26.6271	8.9169	2.85065	1.41044	2227.4	394805
710	504100	357911000	26.6458	8.9211	2.85126	1.40845	2230.5	395919
711	505521	359425431	26.6646	8.9253	2.85187	1.40647	2233.7	397035
712	506944	360944128	26.6833	8.9295	2.85248	1.40449	2236.8	398153
713	508369	362467097	26.7021	8.9337	2.85309	1.40252	2240.0	399272
714	509796	363994344	26.7208	8.9378	2.85370	1.40056	2243.1	400393
715	511225	365525875	26.7395	8.9420	2.85431	1.39860	2246.2	401515
716	512656	367061696	26.7582	8.9462	2.85491	1.39665	2249.4	402639
717	514089	368601813	26.7769	8.9503	2.85552	1.39470	2252.5	403765
718	515524	370146232	26.7955	8.9545	2.85612	1.39276	2255.7	404892
719	516961	371694959	26.8142	8.9587	2.85673	1.39082	2258.8	406020
720	518400	373248000	26.8328	8.9628	2.85733	1.38889	2261.9	407150
721	519841	374805361	26.8514	8.9670	2.85794	1.38696	2265.1	408282
722	521284	376367048	26.8701	8.9711	2.85854	1.38504	2268.2	409415
723	522729	377933067	26.8887	8.9752	2.85914	1.38313	2271.4	410550
724	524176	379503424	26.9072	8.9794	2.85974	1.38122	2274.5	411687
725	525625	381078125	26.9258	8.9835	2.86034	1.37931	2277.7	412825
726	527076	382657176	26.9444	8.9876	2.86094	1.37741	2280.8	413965
727	528529	384240583	26.9629	8.9918	2.86153	1.37552	2283.9	415106
728	529984	385828352	26.9815	8.9959	2.86213	1.37363	2287.1	416248
729	531441	387420489	27.0000	9.0000	2.86273	1.37174	2290.2	417393
730	532900	389017000	27.0185	9.0041	2.86332	1.36986	2293.4	418539
731	534361	390617891	27.0370	9.0082	2.86392	1.36799	2296.5	419686
732	535824	392223168	27.0555	9.0123	2.86451	1.36612	2299.6	420835
733	537289	393832837	27.0740	9.0164	2.86510	1.36426	2302.8	421986
734	538756	395446904	27.0924	9.0205	2.86570	1.36240	2305.9	423138
735	540225	397065375	27.1109	9.0246	2.86629	1.36054	2309.1	424293
736	541696	398688256	27.1293	9.0287	2.86688	1.35870	2312.2	425447
737	543169	400315553	27.1477	9.0328	2.86747	1.35685	2315.4	426604
738	544644	401947272	27.1662	9.0369	2.86806	1.35501	2318.5	427762
739	546121	403583419	27.1846	9.0410	2.86864	1.35318	2321.6	428922
740	547600	405224000	27.2029	9.0450	2.86923	1.35135	2324.8	430084
741	549081	406869021	27.2213	9.0491	2.86982	1.34953	2327.9	431247
742	550564	408518488	27.2397	9.0532	2.87040	1.34771	2331.1	432412
743	552049	410172407	27.2580	9.0572	2.87099	1.34590	2334.2	433578
744	553536	411830784	27.2764	9.0613	2.87157	1.34409	2337.3	434746
745	555025	413493625	27.2947	9.0654	2.87216	1.34228	2340.5	435916
746	556516	415160936	27.3130	9.0694	2.87274	1.34048	2343.6	437087
747	558009	416832723	27.3313	0.0735	2.87332	1.33869	2346.8	438259
748	559504	418508992	27.3496	9.0775	2.87390	1.33690	2349.9	439433
749	561001	420189749	27.3679	9.0816	2.87448	1.33511	2353.1	440609

Functions of Numbers, 750 to 799

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter Circum.	No.=Diameter Area
750	562500	421875000	27.3861	9.0856	2.87506	1.33333	2356.2	441786
751	564001	423564751	27.4044	9.0896	2.87564	1.33156	2359.3	442965
752	565504	425259008	27.4226	9.0937	2.87622	1.32979	2362.5	444146
753	567009	426957777	27.4408	9.0977	2.87680	1.32802	2365.6	445328
754	568516	428661064	27.4591	9.1017	2.87737	1.32626	2368.8	446511
755	570025	430368875	27.4773	9.1057	2.87795	1.32450	2371.9	447697
756	571536	432081216	27.4955	9.1098	2.87852	1.32275	2375.0	448883
757	573049	433798093	27.5136	9.1138	2.87910	1.32100	2378.2	450072
758	574564	435519512	27.5318	9.1178	2.87967	1.31926	2381.3	451262
759	576081	437245479	27.5500	9.1218	2.88024	1.31752	2384.5	452453
760	577600	438976000	27.5681	9.1258	2.88081	1.31579	2387.6	453646
761	579121	440711081	27.5862	9.1293	2.88138	1.31406	2390.8	454841
762	580644	442450728	27.6043	9.1338	2.88196	1.31234	2393.9	456037
763	582169	444194947	27.6225	9.1378	2.88252	1.31062	2397.0	457234
764	583696	445943744	27.6405	9.1418	2.88309	1.30890	2400.2	458434
765	585225	447697125	27.6586	9.1458	2.88366	1.30719	2403.3	459635
766	586756	449455096	27.6767	9.1498	2.88423	1.30548	2406.5	460837
767	588289	451217663	27.6948	9.1537	2.88480	1.30378	2409.6	462041
768	589824	452984832	27.7128	9.1577	2.88536	1.30208	2412.7	463247
769	591361	454756609	27.7308	9.1617	2.88593	1.30039	2415.9	464454
770	592900	456533000	27.7489	9.1657	2.88649	1.29870	2419.0	465663
771	594441	458314011	27.7669	9.1696	2.88705	1.29702	2422.2	466873
772	595984	460099648	27.7849	9.1736	2.88762	1.29534	2425.3	468085
773	597529	461889917	27.8029	9.1775	2.88818	1.29366	2428.5	469298
774	599076	463684824	27.8209	9.1815	2.88874	1.29199	2431.6	470513
775	600625	465484375	27.8388	9.1855	2.88930	1.29032	2434.7	471730
776	602176	467288576	27.8568	9.1894	2.88986	1.28866	2437.9	472948
777	603729	469097433	27.8747	9.1933	2.89042	1.28700	2441.0	474168
778	605284	470910952	27.8927	9.1973	2.89098	1.28535	2444.2	475389
779	606841	472729139	27.9106	9.2012	2.89154	1.28370	2447.3	476612
780	608400	474552000	27.9285	9.2052	2.89209	1.28205	2450.4	477836
781	609961	476379541	27.9464	9.2091	2.89265	1.28041	2453.6	479062
782	611524	478211768	27.9643	9.2130	2.89321	1.27877	2456.7	480290
783	613089	480048687	27.9821	9.2170	2.89376	1.27714	2459.9	481519
784	614656	481890304	28.0000	9.2209	2.89432	1.27551	2463.0	482750
785	616225	483736625	28.0179	9.2248	2.89487	1.27389	2466.2	483982
786	617796	485587656	28.0357	9.2287	2.89542	1.27226	2469.3	485216
787	619369	487443403	28.0535	9.2326	2.89597	1.27065	2472.4	486451
788	620944	489303872	28.0713	9.2365	2.89653	1.26904	2475.6	487688
789	622521	491169069	28.0891	9.2404	2.89708	1.26743	2478.7	488927
790	624100	493039000	28.1069	9.2443	2.89763	1.26582	2481.9	490167
791	625681	494913671	28.1247	9.2482	2.89818	1.26422	2485.0	491409
792	627264	496793088	28.1425	9.2521	2.89873	1.26263	2488.1	492652
793	628849	498677257	28.1603	9.2560	2.89927	1.26103	2491.3	493897
794	630436	500566184	28.1780	9.2599	2.89982	1.25945	2494.4	495143
795	632025	502459875	28.1957	9.2638	2.90037	1.25786	2497.6	496391
796	633616	504358336	28.2135	9.2677	2.90091	1.25628	2500.7	497641
797	635209	506261573	28.2312	9.2716	2.90146	1.25471	2503.8	498892
798	636804	508169592	28.2489	9.2754	2.90200	1.25313	2507.0	500145
799	638401	510082399	28.2666	9.2793	2.90255	1.25156	2510.1	501399

Functions of Numbers, 800 to 849

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter Circum.	Area
800	640000	512000000	28.2843	9.2832	2.90309	1.25000	2513.3	502655
801	641601	513922401	28.3019	9.2870	2.90363	1.24844	2516.4	503912
802	643204	515849608	28.3196	9.2909	2.90417	1.24688	2519.6	505171
803	644809	517781627	28.3373	9.2948	2.90472	1.24533	2522.7	506432
804	646416	519718464	28.3549	9.2986	2.90526	1.24378	2525.8	507694
805	648025	521660125	28.3725	9.3025	2.90580	1.24224	2529.0	508958
806	649636	523606616	28.3901	9.3063	2.90634	1.24069	2532.1	510223
807	651249	525557943	28.4077	9.3102	2.90687	1.23916	2535.3	511490
808	652864	527514112	28.4253	9.3140	2.90741	1.23762	2538.4	512758
809	654481	529475129	28.4429	9.3179	2.90795	1.23609	2541.5	514028
810	656100	531441000	28.4605	9.3217	2.90849	1.23457	2544.7	515300
811	657721	533411731	28.4781	9.3255	2.90902	1.23305	2547.8	516573
812	659344	535387328	28.4956	9.3294	2.90956	1.23153	2551.0	517848
813	660969	537367797	28.5132	9.3332	2.91009	1.23001	2554.1	519124
814	662596	539353144	28.5307	9.3370	2.91062	1.22850	2557.3	520402
815	664225	541343375	28.5482	9.3403	2.91116	1.22699	2560.4	521681
816	665856	543338496	28.5657	9.3447	2.91169	1.22549	2563.5	522962
817	667489	545338513	28.5832	9.3485	2.91222	1.22399	2566.7	524245
818	669124	547343432	28.6007	9.3523	2.91275	1.22249	2569.8	525529
819	670761	549353259	28.6182	9.3561	2.91328	1.22100	2573.0	526814
820	672400	551368000	28.6356	9.3599	2.91381	1.21951	2576.1	528102
821	674041	553387661	28.6531	9.3637	2.91434	1.21803	2579.2	529391
822	675684	555412248	28.6705	9.3675	2.91487	1.21655	2582.4	530681
823	677329	557441767	28.6880	9.3713	2.91540	1.21507	2585.5	531973
824	678976	559476224	28.7054	9.3751	2.91593	1.21359	2588.7	533267
825	680625	561515625	28.7228	9.3789	2.91645	1.21212	2591.8	534562
826	682276	563559976	28.7402	9.3827	2.91698	1.21065	2595.0	535858
827	683929	565609283	28.7576	9.3865	2.91751	1.20919	2598.1	537157
828	685584	567663552	28.7750	9.3902	2.91803	1.20773	2601.2	538456
829	687241	569722789	28.7924	9.3940	2.91855	1.20627	2604.4	539758
830	688900	571787000	28.8097	9.3978	2.91908	1.20482	2607.5	541061
831	690561	573856191	28.8271	9.4016	2.91960	1.20337	2610.7	542365
832	692224	575930368	28.8444	9.4053	2.92012	1.20192	2613.8	543671
833	693889	578009537	28.8617	9.4091	2.92065	1.20048	2616.9	544979
834	695556	580093704	28.8791	9.4129	2.92117	1.19904	2620.1	546288
835	697225	582182875	28.8964	9.4166	2.92169	1.19760	2623.2	547599
836	698896	584277056	28.9137	9.4204	2.92221	1.19617	2626.4	548912
837	700569	586376253	28.9310	9.4241	2.92273	1.19474	2629.5	550226
838	702244	588480472	28.9482	9.4279	2.92324	1.19332	2632.7	551541
839	703921	590589719	28.9655	9.4316	2.92376	1.19190	2635.8	552858
840	705600	592704000	28.9828	9.4354	2.92428	1.19048	2638.9	554177
841	707281	594823321	29.0000	9.4391	2.92480	1.18906	2642.1	555497
842	708964	596947688	29.0172	9.4429	2.92531	1.18765	2645.2	556819
843	710649	599077107	29.0345	9.4466	2.92583	1.18624	2648.4	558142
844	712336	601211584	29.0517	9.4503	2.92634	1.18483	2651.5	559467
845	714025	603351125	29.0689	9.4541	2.92686	1.18343	2654.6	560794
846	715716	605495736	29.0861	9.4578	2.92737	1.18203	2657.8	562122
847	717409	607645423	29.1033	9.4615	2.92788	1.18064	2660.9	563452
848	719104	609800192	29.1204	9.4652	2.92840	1.17925	2664.1	564783
849	720801	611960049	29.1376	9.4690	2.92891	1.17786	2667.2	566116

Functions of Numbers, 850 to 899

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter Circum.	Area
850	722500	614125000	29.1548	9.4727	2.92942	1.17647	2670.4	567450
851	724201	616295051	29.1719	9.4764	2.92993	1.17509	2673.5	568786
852	725904	618470208	29.1890	9.4801	2.93044	1.17371	2676.6	570124
853	727609	620650477	29.2062	9.4838	2.93095	1.17233	2679.8	571463
854	729316	622835864	29.2233	9.4875	2.93146	1.17096	2682.9	572803
855	731025	625026375	29.2404	9.4912	2.93197	1.16959	2686.1	574146
856	732736	627222016	29.2575	9.4949	2.93247	1.16822	2689.2	575490
857	734449	629422793	29.2746	9.4986	2.93298	1.16686	2692.3	576835
858	736164	631628712	29.2916	9.5023	2.93349	1.16550	2695.5	578182
859	737881	633839779	29.3087	9.5060	2.93399	1.16414	2698.6	579530
860	739600	636056000	29.3258	9.5097	2.93450	1.16279	2701.8	580880
861	741321	638277381	29.3428	9.5134	2.93500	1.16144	2704.9	582232
862	743044	640503928	29.3598	9.5171	2.93551	1.16009	2708.1	583585
863	744769	642735647	29.3769	9.5207	2.93601	1.15875	2711.2	584940
864	746496	644972544	29.3939	9.5244	2.93651	1.15741	2714.3	586297
865	748225	647214625	29.4109	9.5281	2.93702	1.15607	2717.5	587655
866	749956	649461896	29.4279	9.5317	2.93752	1.15473	2720.6	589014
867	751689	651714363	29.4449	9.5354	2.93802	1.15340	2723.8	590375
868	753424	653972032	29.4618	9.5391	2.93852	1.15207	2726.9	591738
869	755161	656234909	29.4788	9.5427	2.93902	1.15075	2730.0	593102
870	756900	658503000	29.4958	9.5464	2.93952	1.14943	2733.2	594468
871	758641	660776311	29.5127	9.5501	2.94002	1.14811	2736.3	595835
872	760384	663054848	29.5296	9.5537	2.94052	1.14679	2739.5	597204
873	762129	665338617	29.5466	9.5574	2.94101	1.14548	2742.6	598575
874	763876	667627624	29.5635	9.5610	2.94151	1.14416	2745.8	599947
875	765625	669921875	29.5804	9.5647	2.94201	1.14286	2748.9	601320
876	767376	672221376	29.5973	9.5683	2.94250	1.14155	2752.0	602696
877	769129	674526133	29.6142	9.5719	2.94300	1.14025	2755.2	604073
878	770884	676836152	29.6311	9.5756	2.94349	1.13895	2758.3	605451
879	772641	679151439	29.6479	9.5792	2.94399	1.13766	2761.5	606831
880	774400	681472000	29.6648	9.5828	2.94448	1.13636	2764.6	608212
881	776161	683797841	29.6816	9.5865	2.94498	1.13507	2767.7	609595
882	777924	686128968	29.6985	9.5901	2.94547	1.13379	2770.9	610980
883	779689	688465387	29.7153	9.5937	2.94596	1.13250	2774.0	612366
884	781456	690807104	29.7321	9.5973	2.94645	1.13122	2777.2	613754
885	783225	693154125	29.7489	9.6010	2.94694	1.12994	2780.3	615143
886	784996	695506456	29.7658	9.6046	2.94743	1.12867	2783.5	616534
887	786769	697864103	29.7825	9.6082	2.94792	1.12740	2786.6	617927
888	788544	700227072	29.7993	9.6118	2.94841	1.12613	2789.7	619321
889	790321	702595369	29.8161	8.6154	2.94890	1.12486	2792.9	620717
890	792100	704969000	29.8329	9.6190	2.94939	1.12360	2796.0	622114
891	793881	707347971	29.8496	9.6226	2.94988	1.12233	2799.2	623513
892	795664	709732288	29.8664	9.6262	2.95036	1.12108	2802.3	624913
893	797449	712121957	29.8831	9.6298	2.95085	1.11982	2805.4	626315
894	799236	714516984	29.8998	9.6334	2.95134	1.11857	2808.6	627718
895	801025	716917375	29.9166	9.6370	2.95182	1.11732	2811.7	629124
896	802816	719323136	29.9333	9.6406	2.95231	1.11607	2814.9	630530
897	804609	721734273	29.9500	9.6442	2.95279	1.11483	2818.0	631938
898	806404	724150792	29.9666	9.6477	2.95328	1.11359	2821.2	633348
899	808201	726572699	29.9833	9.6513	2.95376	1.11235	2824.3	634760

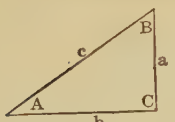
Functions of Numbers, 900 to 949

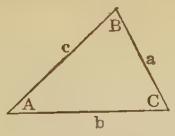
No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter Circum.	Area
900	810000	729000000	30.0000	9.6549	2.95424	1.11111	2827.4	636173
901	811801	731432701	30.0167	9.6585	2.95472	1.10988	2830.6	637587
902	813604	733870808	30.0333	9.6620	2.95521	1.10865	2833.7	639003
903	815409	736314327	30.0500	9.6656	2.95569	1.10742	2836.9	640421
904	817216	738763264	30.0666	9.6692	2.95617	1.10619	2840.0	641840
905	819025	741217625	30.0832	9.6727	2.95665	1.10497	2843.1	643261
906	820836	743677416	30.0998	9.6763	2.95713	1.10375	2846.3	644683
907	822649	746142643	30.1164	9.6799	2.95761	1.10254	2849.4	646107
908	824464	748613312	30.1330	9.6834	2.95809	1.10132	2852.6	647533
909	826281	751089429	30.1496	9.6870	2.95856	1.10011	2855.7	648960
910	828100	753571000	30.1662	9.6905	2.95904	1.09890	2858.8	650388
911	829921	756058031	30.1828	9.6941	2.95952	1.09769	2862.0	651818
912	831744	758550528	30.1993	9.6976	2.95999	1.09649	2865.1	653250
913	833569	761048497	30.2159	9.7012	2.96047	1.09529	2868.3	654684
914	835396	763551944	30.2324	9.7047	2.96095	1.09409	2871.4	656118
915	837225	766060875	30.2490	9.7082	2.96142	1.09290	2874.6	657555
916	839056	768575296	30.2655	9.7118	2.96190	1.09170	2877.7	658993
917	840889	771095213	30.2820	9.7153	2.96237	1.09051	2880.8	660433
918	842724	773620632	30.2985	9.7188	2.96284	1.08932	2884.0	661874
919	844561	776151559	30.3150	9.7224	2.96332	1.08814	2887.1	663317
920	846400	778688000	30.3315	9.7259	2.96379	1.08696	2890.3	664761
921	848241	781229961	30.3480	9.7294	2.96426	1.08578	2893.4	666207
922	850084	783777448	30.3645	9.7329	2.96473	1.08460	2896.5	667654
923	851929	786330467	30.3809	9.7364	2.96520	1.08342	2899.7	669103
924	853776	788889024	30.3974	9.7400	2.96567	1.08225	2902.8	670554
925	855625	791453125	30.4138	9.7435	2.96614	1.08108	2906.0	672006
926	857476	794022776	30.4302	9.7470	2.96661	1.07991	2909.1	673460
927	859329	796597983	30.4467	9.7505	2.96708	1.07875	2912.3	674915
928	861184	799178752	30.4631	9.7540	2.96755	1.07759	2915.4	676372
929	863041	801765089	30.4795	9.7575	2.96802	1.07643	2918.5	677831
930	864900	804357000	30.4959	9.7610	2.96848	1.07527	2921.7	679291
931	866761	806954491	30.5123	9.7645	2.96895	1.07411	2924.8	680752
932	868624	809557568	30.5287	9.7680	2.96942	1.07296	2928.0	682216
933	870489	812166237	30.5450	9.7715	2.96988	1.07181	2931.1	683680
934	872356	814780504	30.5614	9.7750	2.97035	1.07066	2934.2	685147
935	874225	817400375	30.5778	9.7785	2.97081	1.06952	2937.4	686615
936	876096	820025856	30.5941	9.7819	2.97128	1.06838	2940.5	688084
937	877969	822656953	30.6105	9.7854	2.97174	1.06724	2943.7	689555
938	879844	825293672	30.6268	9.7889	2.97220	1.06610	2946.8	691028
939	881721	827936019	30.6431	9.7924	2.97267	1.06496	2950.0	692502
940	883600	830584000	30.6594	9.7959	2.97313	1.06383	2953.1	693978
941	885481	833237621	30.6757	9.7993	2.97359	1.06270	2956.2	695455
942	887364	835896888	30.6920	9.8028	2.97405	1.06157	2959.4	696934
943	889249	838561807	30.7083	9.8063	2.97451	1.06045	2962.5	698415
944	891136	841232384	30.7246	9.8097	2.97497	1.05932	2965.7	699897
945	893025	843908625	30.7409	9.8132	2.97543	1.05820	2968.8	701380
946	894916	846590536	30.7571	9.8167	2.97589	1.05708	2971.9	702865
947	896809	849278123	30.7734	9.8201	2.97635	1.05597	2975.1	704352
948	898704	851971392	30.7896	9.8236	2.97681	1.05485	2978.2	705840
949	900601	854670349	30.8058	9.8270	2.97727	1.05374	2981.4	707330

FUNCTIONS OF NUMBERS, 950 TO 999

No.	Square	Cube	Square Root	Cubic Root	Logarithm	1000 x Reciprocal	No.=Diameter	
							Circum.	Area
950	902500	857375000	30.8221	9.8305	2.97772	1.05263	2984.5	708822
951	904401	860085351	30.8383	9.8339	2.97818	1.05152	2987.7	710315
952	906304	862801408	30.8545	9.8374	2.97864	1.05042	2990.8	711809
953	908209	865523177	30.8707	9.8408	2.97909	1.04932	2993.9	713306
954	910116	868250664	30.8869	9.8443	2.97955	1.04822	2997.1	714803
955	912025	870983875	30.9031	9.8477	2.98000	1.04712	3000.2	716303
956	913936	873722816	30.9192	9.8511	2.98046	1.04603	3003.4	717804
957	915849	876467493	30.9354	9.8546	2.98091	1.04493	3006.5	719306
958	917764	879217912	30.9516	9.8580	2.98137	1.04384	3009.6	720810
959	919681	881974079	30.9677	9.8614	2.98182	1.04275	3012.8	722316
960	921600	884736000	30.9839	9.8648	2.98227	1.04167	3015.9	723823
961	923521	887503681	31.0000	9.8683	2.98272	1.04058	3019.1	725332
962	925444	890277128	31.0161	9.8717	2.98318	1.03950	3022.2	726842
963	927369	893056347	31.0322	9.8751	2.98363	1.03842	3025.4	728354
964	929296	895841344	31.0483	9.8785	2.98408	1.03734	3028.5	729867
965	931225	898632125	31.0644	9.8819	2.98453	1.03627	3031.6	731382
966	933156	901428696	31.0805	9.8854	2.98498	1.03520	3034.8	732899
967	935089	904231063	31.0966	9.8888	2.98543	1.03413	3037.9	734417
968	937024	907039232	31.1127	9.8922	2.98588	1.03306	3041.1	735937
969	938961	909853209	31.1288	9.8956	2.98632	1.03199	3044.2	737458
970	940900	912673000	31.1448	9.8990	2.98677	1.03093	3047.3	738981
971	942841	915498611	31.1609	9.9024	2.98722	1.02987	3050.5	740506
972	944784	918330048	31.1769	9.9058	2.98767	1.02881	3053.6	742032
973	946729	921167317	31.1929	9.9092	2.98811	1.02775	3056.8	743559
974	948676	924010424	31.2090	9.9126	2.98856	1.02669	3059.9	745088
975	950625	926859375	31.2250	9.9160	2.98900	1.02564	3063.1	746619
976	952576	929714176	31.2410	9.9194	2.98945	1.02459	3066.2	748151
977	954529	932574833	31.2570	9.9227	2.98989	1.02354	3069.3	749685
978	956484	935441352	31.2730	9.9261	2.99034	1.02249	3072.5	751221
979	958441	938313739	31.2890	9.9295	2.99078	1.02145	3075.6	752758
980	960400	941192000	31.3050	9.9329	2.99123	1.02041	3078.8	754296
981	962361	944076141	31.3209	9.9363	2.99167	1.01937	3081.9	755837
982	964324	946966168	31.3369	9.9396	2.99211	1.01833	3085.0	757378
983	966289	949862087	31.3528	9.9430	2.99255	1.01729	3088.2	758922
984	968256	952763904	31.3688	9.9464	2.99300	1.01626	3091.3	760466
985	970225	955671625	31.3847	9.9497	2.99344	1.01523	3094.5	762013
986	972196	958585256	31.4006	9.9531	2.99388	1.01420	3097.6	763561
987	974169	961504803	31.4166	9.9565	2.99432	1.01317	3100.8	765111
988	976144	964430272	31.4325	9.9598	2.99476	1.01215	3103.9	766662
989	978121	967361669	31.4484	9.9632	2.99520	1.01112	3107.0	768214
990	980100	970299000	31.4643	9.9666	2.99564	1.01010	3110.2	769769
991	982081	973242271	31.4802	9.9699	2.99607	1.00908	3113.3	771325
992	984064	976191488	31.4960	9.9733	2.99651	1.00806	3116.5	772882
993	986049	979146657	31.5119	9.9766	2.99695	1.00705	3119.6	774441
994	988036	982107784	31.5278	9.9800	2.99739	1.00604	3122.7	776002
995	990025	985074875	31.5436	9.9833	2.99782	1.00503	3125.9	777564
996	992016	988047936	31.5595	9.9866	2.99826	1.00402	3129.0	779128
997	994009	991026973	31.5753	9.9900	2.99870	1.00301	3132.2	780693
998	996004	994011992	31.5911	9.9933	2.99913	1.00200	3135.3	782260
999	998001	997002999	31.6070	9.9967	2.99957	1.00100	3138.5	783828

TRIGONOMETRIC SOLUTION OF TRIANGLES



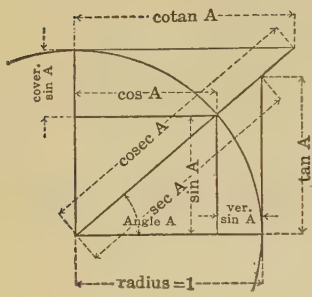


$S = \frac{a+b+c}{2}$

Given	Sought	Formulae
		Right-Angled Triangles
a, c	A, B, b	$\sin A = \frac{a}{c}$, $\cos B = \frac{a}{c}$, $b = \sqrt{c^2 - a^2}$
	Area	Area $= \frac{a}{2}\sqrt{c^2-a^2}$
a, b	A, B, c	$\tan A = \frac{a}{b}$, $\tan B = \frac{b}{a}$, $c = \sqrt{a^2 + b^2}$
	Area	Area $= \frac{a\,b}{2}$
A, a	B, b, c	$B = 90^\circ - A$, $b = a \cot A$, $c = \frac{a}{\sin A}$
	Area	Area $= \frac{a^2 \cot A}{2}$
A, b	B, a, c	$B = 90^\circ - A$, $a = b \tan A$, $c = \frac{b}{\cos A}$
	Area	Area $= \frac{b^2 \tan A}{2}$
A, c	B, a, b	$B = 90^\circ - A$, $a = c \sin A$, $b = c \cos A$
	Area	Area $= \frac{c^2 \sin A \cos A}{2}$ or $\frac{c^2 \sin 2A}{4}$
		Oblique-Angled Triangles
a, b, c	A	$\sin \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{b\,c}}$, $\cos \frac{1}{2}A = \sqrt{\frac{s(s-a)}{b\,c}}$, $\tan \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$
	B	$\sin \frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{a\,c}}$, $\cos \frac{1}{2}B = \sqrt{\frac{s(s-b)}{a\,c}}$, $\tan \frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{s(s-b)}}$
	C	$\sin \frac{1}{2}C = \sqrt{\frac{(s-a)(s-b)}{a\,b}}$, $\cos \frac{1}{2}C = \sqrt{\frac{s(s-c)}{a\,b}}$, $\tan \frac{1}{2}C = \sqrt{\frac{(s-a)(s-b)}{s(s-c)}}$
	Area	Area $= \sqrt{s(s-a)(s-b)(s-c)}$
a, A, B	b, c	$b = \frac{a \sin B}{\sin A}$ $c = \frac{a \sin C}{\sin A} = \frac{a \sin (A+B)}{\sin A}$
	Area	Area $= \frac{1}{2}\,a\,b \sin C = \frac{a^2 \sin B \sin C}{2 \sin A}$
a, b, A	B	$\sin B = \frac{b \sin A}{a}$
	c	$c = \frac{a \sin C}{\sin A} = \frac{b \sin C}{\sin B} = \sqrt{a^2 + b^2 - 2\,ab \cos C}$
	Area	Area $= \frac{1}{2}\,a\,b \sin C$
a, b, C	A	$\tan A = \frac{a \sin C}{b - a \cos C}$, $\tan \frac{1}{2}(A-B) = \frac{a-b}{a+b} \cot \frac{1}{2}C$
	c	$c = \sqrt{a^2 + b^2 - 2\,ab \cos C} = \frac{a \sin C}{\sin A}$
	Area	Area $= \frac{1}{2}\,ab \sin C$

$a^2 = b^2 + c^2 - 2bc \cos A$, $b^2 = a^2 + c^2 - 2\,a\,c \cos B$ $c^2 = a^2 + b^2 - 2\,ab \cos C$

TRIGONOMETRIC FORMULAS



Radius, $1 = \sin^2 A + \cos^2 A$

$= \sin A \operatorname{cosec} A = \cos A \sec A = \tan A \cot A$

Sine $A = \frac{\cos A}{\cot A} = \frac{1}{\operatorname{cosec} A} = \cos A \tan A = \sqrt{1 - \cos^2 A}$

Cosine $A = \frac{\sin A}{\tan A} = \frac{1}{\sec A} = \sin A \cot A = \sqrt{1 - \sin^2 A}$

Tangent $A = \frac{\sin A}{\cos A} = \frac{1}{\cot A} = \sin A \sec A$

Cotangent $A = \frac{\cos A}{\sin A} = \frac{1}{\tan A} = \cos A \operatorname{cosec} A$

Secant $A = \frac{\tan A}{\sin A} = \frac{1}{\cos A}$

Cosecant $A = \frac{\cot A}{\cos A} = \frac{1}{\sin A}$

$\sin (A \pm B) = \sin A \cos B \pm \cos A \sin B$

$\cos (A \pm B) = \cos A \cos B \mp \sin A \sin B$

$\sin A + \sin B = 2 \sin \frac{1}{2}(A + B) \cos \frac{1}{2}(A - B)$

$\sin A - \sin B = 2 \cos \frac{1}{2}(A + B) \sin \frac{1}{2}(A - B)$

$\cos A + \cos B = 2 \cos \frac{1}{2}(A + B) \cos \frac{1}{2}(A - B)$

$\cos B - \cos A = 2 \sin \frac{1}{2}(A + B) \sin \frac{1}{2}(A - B)$

$\sin 2A = 2 \sin A \cos A$

$\cos 2A = \cos^2 A - \sin^2 A$

$\sin \frac{1}{2} A = \sqrt{\frac{1 - \cos A}{2}}$ $\quad \cos \frac{1}{2} A = \sqrt{\frac{1 + \cos A}{2}}$

$\sin^2 A = \frac{1 - \cos 2A}{2}$ $\quad \cos^2 A = \frac{1 + \cos 2A}{2}$

$\sin^2 A - \sin^2 B = \sin (A + B) \sin (A - B)$

$\frac{\sin A \pm \sin B}{\cos A + \cos B} = \tan \frac{1}{2}(A \pm B)$

$\tan (A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

$\cot (A \pm B) = \frac{\cot A \cot B \mp 1}{\cot B \pm \cot A}$

$\tan A + \tan B = \frac{\sin (A + B)}{\cos A \cos B}$

$\tan A - \tan B = \frac{\sin (A - B)}{\cos A \cos B}$

$\cot A + \cot B = \frac{\sin (B + A)}{\sin A \sin B}$

$\cot A - \cot B = \frac{\sin (B - A)}{\sin A \sin B}$

$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$

$\cot 2A = \frac{\cot^2 A - 1}{2 \cot A}$

$\tan \frac{1}{2} A = \frac{\sin A}{1 + \cos A}$ $\quad \cot \frac{1}{2} A = \frac{\sin A}{1 - \cos A}$

$\tan^2 A = \frac{1 - \cos 2A}{1 + \cos 2A}$ $\quad \cot^2 A = \frac{1 + \cos 2A}{1 - \cos 2A}$

$\cos^2 A - \sin^2 B = \cos (A + B) \cos (A - B)$

$\frac{\sin A \pm \sin B}{\cos B - \cos A} = \cot \frac{1}{2}(A \mp B)$

Quadrant	I	II	III	IV	Angle		
Angles	0° to 90°	90° to 180°	180° to 270°	270° to 360°	30°	45°	60°
Functions	Values vary from				Equivalent values		
sin	+0 to +1	+1 to +0	−0 to −1	−1 to −0	$\frac{1}{2}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}\sqrt{3}$
cos	+1 to +0	−0 to −1	−1 to −0	+0 to +1	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}$
tan	+0 to +∞	−∞ to −0	+0 to +∞	−∞ to −0	$\frac{1}{3}\sqrt{3}$	1	$\sqrt{3}$
cot	+∞ to +0	−0 to −∞	+∞ to +0	−0 to −∞	$\sqrt{3}$	1	$\frac{1}{3}\sqrt{3}$

Angle a < 90°				
Angle	sin	cos	tan	cot
$\phi°$	$\phi°$	$\phi°$	$\phi°$	$\phi°$
$0° \pm a$	$\pm \sin a$	$+\cos a$	$\pm \tan a$	$\pm \cot a$
$90° \pm a$	$+\cos a$	$\mp \sin a$	$\mp \cot a$	$\mp \tan a$
$180° \pm a$	$\mp \sin a$	$-\cos a$	$\pm \tan a$	$\pm \cot a$
$270° \pm a$	$-\cos a$	$\pm \sin a$	$\mp \cot a$	$\mp \tan a$

CHAPTER XXVII

SIDEWALKS, CURBS AND GUTTERS

Sidewalks.—According to generally accepted usage, sidewalks may be defined as pavements placed between the curb and the property line, for the use of pedestrians. The location of the walk governs its width, those in residential streets running from 4 to 6 ft. in width, while those in business sections usually extend from the curb to the building line.

Qualifications.—A good sidewalk is smooth but not slippery, of uniform quality and with a good wearing surface. This surface should be non absorbent, durable and low in first cost and in maintenance. The materials in common use are concrete, brick, asphalt, stone slabs, macadam and gravel.

Slope.—The surface of walks should either be crowned at the center or have a slope towards the curb for drainage of surface water. The slope should vary from 1 in. in 3 ft. to 1 in. in 5 ft. The amount of slope required will depend on the roughness of the finish.

Concrete Walks.—Concrete makes a permanent walk when properly constructed, can be made with any surface finish desired and is adaptable to practically all conditions. It can be installed economically in most localities.

Most walks are located without consideration to local conditions of soil or drainage. Proper provision must therefore be made in putting down the foundation or sub-base to prevent disintegration. Where the nature of the soil is such as to provide good drainage, no sub-base is necessary, but where there is a possibility of surface water accumulating under the walk, with the resultant heaving due to frost, a porous sub-base properly graded and drained should be installed. When fill is required to bring the walk to the proper grade, it should be placed in layers about 6 in. thick, well tamped, and extended at least a foot beyond the edge of the walk with a slope of 1 to 1.5. The sub-base consisting of cinders, broken stone or gravel, should be at least 6 in. thick, thoroughly compacted by wetting and tamping, so as to form an even bearing for the concrete slab.

Forms.—When the sub-base is laid and properly graded, wood or steel forms are put in place. The forms should extend from the sub-base to the level of the finished walk, the curb side being lowered for the required pitch. Wood forms are usually staked on the outside of the form, whereas steel forms are held in place by their cross ties or partition strips. The partition strips should be spaced so that no slab is longer or wider than 6 ft. Where continuous walks are run instead of alternate blocks, 1 in. boards are used for partitions and removed after the base has received its initial set. The surface coat is then cut through over the joints in the base course with a grooving tool.

Concrete.—The correct proportioning of the materials and the requisite amount of water are the principal governing factors in the strength and wearing qualities of concrete. The quality and strength of the concrete will be affected by the proportion of cement, sand and stone, the amount of mixing water as well as by the placing of the concrete and its protection while setting and hardening. The proportions of materials should be such that the cement will fill the voids in the sand and with the sand make a volume of mortar which will be slightly in excess of the voids in the stone or other course aggregate.

Proportions.—On page 116 is a table of "Recommended Mixtures" for various purposes, from which the proportions for the courses in concrete walks may be obtained. The following table will give the amounts of material required:

MATERIALS REQUIRED FOR 100 SQ. FT. OF SIDEWALKS AND FLOORS FOR VARYING THICKNESS OF COURSE

CEMENT BASE

Proportions.....	1:2:3			1:2:4			1:2½:4			1:2½:5		
Thickness	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone
2½	5.4	0.40	0.60	4.6	0.34	0.68	4.3	0.40	0.63	3.9	0.36	0.72
3	6.5	0.48	0.72	5.6	0.41	0.82	5.2	0.48	0.77	4.6	0.43	0.86
3½	7.5	0.56	0.84	6.5	0.48	0.96	6.0	0.56	0.89	5.4	0.50	1.00
4	8.6	0.64	0.95	7.4	0.55	1.10	6.9	0.64	1.02	6.2	0.57	1.14
4½	9.7	0.72	1.07	8.3	0.62	1.23	7.7	0.72	1.14	6.9	0.64	1.28
5	10.8	0.80	1.19	9.3	0.69	1.37	8.6	0.80	1.27	7.7	0.71	1.43
5½	11.8	0.88	1.31	10.2	0.76	1.50	9.5	0.87	1.40	8.5	0.78	1.57
6	12.9	0.96	1.43	11.1	0.82	1.64	10.3	0.95	1.53	9.2	0.86	1.72

WEARING COURSE

Proportion.....	1:1		1:1½		1:2	
Thickness, inches	Cement	Sand	Cement	Sand	Cement	Sand
½	3.0	0.11	2.4	0.13	2.0	0.15
¾	4.5	0.16	3.6	0.19	2.9	0.22
1	6.0	0.22	4.8	0.26	3.9	0.29
1¼	7.5	0.27	6.0	0.33	4.9	0.36
1½	9.0	0.33	7.2	0.40	5.9	0.43
1¾	10.5	0.39	8.4	0.46	6.9	0.50
2	12.0	0.45	9.6	0.53	7.9	0.58

NOTE.—Quantities expressed in the following units:
Cement—sacks;
Sand—cubic yards;
Pebbles or broken stone—cubic yards.

Fill for Sub-base.—The amount of fill required for each inch in thickness per 100 sq. ft. is about ⅓ cu. yd. One man will spread and tamp about 70 sq. ft. of fill 6 in. thick per hour.

Labor.—A gang of 6 men will lay about 500 sq. ft. of two-course walk in 8 hr., including mixing, laying and finishing, or 83 sq. ft. per man per day of 8 hr. This is for one finisher and five laborers.

The following is a specification suggested by the Atlas Portland Cement Company for concrete walks and curbs:

CONCRETE SIDEWALKS

ONE-COURSE CONSTRUCTION

I. Definitions of Terms.—The term Engineer shall mean the City Engineer or other person appointed by the City to oversee sidewalk construction.

The term Contractor shall mean the party or parties contracting to do any work described herein, or authorized representatives of such party or parties.

II. Sampling and Testing Materials.—Before delivery upon the job, and at such other times as the engineer deems necessary, the contractor shall furnish any required samples of the material hereinafter mentioned. Materials shall pass the following requirements.

1. *Cement.*—The cement shall meet the requirements of the current Standard Specifications for portland cement of the American Society for Testing Materials. A sack containing 94 lb. of cement will be considered 1 cu. ft.

2. *Fine Aggregate.*—The fine aggregate shall consist of clean, hard, durable, uncoated particles of sand or stone, free from lumps of clay and all organic material. One hundred per cent shall pass a ¼-inch screen and 95 per cene shall be retained on a 100-mesh screen. Not more than 25 per cent shall pass a 50-mesh screen. It shall be well graded from coarse to fine.

When the fine aggregate is mixed with portland cement in the proportion of one part cement to three parts fine aggregate by weight, according to the standard method of making briquets, the resulting mortar at the age of 7 and 28 days shall have a tensile strength at least equal to that developed in the same time by mortar of the same proportions and consistency made of the same cement and standard Ottawa sand.

3. *Coarse Aggregate.*—Coarse aggregate may be broken stone, gravel or blast-furnace slag.

The broken stone or gravel shall be clean, hard, durable, uncoated rock. It shall contain no vegetable or other deleterious matter and shall be free from soft, thin, elongated or laminated pieces.

Slag shall be air cooled, non-glassy and shall have been exposed to the weather at least one year. Its specific gravity shall be not less than 2.6.

The French Coefficient of Wear for the coarse aggregate shall be not less than 5. One hundred per cent shall pass a 1-in. screen and at least 95 per cent shall be retained on a ¼-in. screen, with all intermediate sizes retained.

4. *Water.*—Water shall be clean and free from alkali, oils, or acid.

5. *Joint Filler.*—Joint filler shall be premolded strips of asphalt or pitch, and fiber or mineral aggregate passing an 80-mesh screen, one-half (½) inch thick, as wide as the thickness of the concrete slab and at least two (2) feet long. It shall have such a consistency that it will not run in summer or chip out in winter.

6. *Forms.*—Forms shall be of lumber 2 in. thick, or of steel of equal strength, except on curves, where flexible strips may be used.

They shall be held rigidly in place by stakes or braces with top edges at true line and grade given by the engineer. Ends of adjoining forms shall be flush.

Where sidewalks fill the space between curb and building lines, forms shall be set to give the walk a slope toward the curb of ¼ in. per foot of width.

Where walks are bordered by lawns, forms shall be set level and drainage of the walk secured by a crown of ¼ in. for each foot from side to center.

7. *Division Plates.*—Where division plates are used they shall be of ⅛-in. steel, as wide as the depth of the slab and as long as the width of the walk.

Forms and division plates shall be thoroughly cleaned and oiled each time before they are used.

III. Subgrade.—That portion of the ground surface directly beneath the slab shall be called the subgrade.

All soft and spongy material in the subgrade shall be removed and replaced with suitable material. Fills shall be compacted in layers not exceeding 6 in. in thickness. Spots previously compacted by traffic shall be loosened to a depth of 6 in. The whole subgrade shall be thoroughly and uniformly compacted to a firm surface having as nearly as possible a uniform bearing power.

A template, resting upon the side forms and having its lower edge at the exact elevation of the subgrade, shall be drawn along the forms before any concrete is laid. Any high places in the subgrade shall be removed so that the template will pass over without being raised off the side forms or being tipped at an angle to the sidewalk surface.

The subgrade shall be damp, but not muddy, when concrete is placed upon it.

IV. Drains.—Where in the opinion of the engineer it is considered necessary to save the walk from damage by frost action, drains of 4-in. tile shall be laid on the lines and grades given by the engineer.

V. Sub-base.—When drains are impracticable and the soil is poorly drained, a 5-in. sub-base shall be constructed of cinders, gravel or other porous material approved by the engineer. The sub-base shall be thoroughly tamped until the surface is firm.

VI. Thickness and Proportions.—The sidewalk shall consist of one five (5) inch course of concrete in the proportion of one (1) part of portland cement, two and one-half ($2\frac{1}{2}$) parts of fine aggregate and four (4) parts of coarse aggregate. All materials shall be accurately measured in a manner approved by the engineer.

VII. Mixing.—The ingredients of the concrete shall be thoroughly mixed until each particle of fine aggregate is coated with cement and each particle of coarse aggregate is coated with mortar.

Where a mechanical mixer is used it shall be of an approved batch type. Each batch shall be mixed at least 1 min. from the time all the materials including water are in the drum before the beginning of the discharge.

The consistency of the mixed concrete shall be such that no separation of the ingredients shall take place and some tamping is necessary to bring the mortar to the surface.

VIII. Placing and Finishing.—The freshly mixed concrete shall be placed immediately on the prepared subgrade. It shall then be struck off and tamped with a straightedge or curved template having a crown of $\frac{1}{4}$ in. per foot resting upon the side forms and advanced with a crosswise sawing motion.

It shall then be rolled with a light sheet-iron roller weighing approximately 1 lb. per linear inch of surface contact or floated with a wooden float until the surface has a true contour and the concrete is thoroughly compacted.

The placing of concrete shall not be suspended for 45 min. or longer except at the end of a slab.

No concrete shall be placed on a frozen subgrade or when the temperature is, or is liable to be within 24 hr., below 35°F., except with the written permission of the engineer.

IX. Jointing.—The walk shall be cut into separate rectangular slabs. No plain concrete slab shall be longer than six (6) feet on any one side.

Where division plates have been used, they shall be removed after the concrete has hardened sufficiently to avoid breaking the edges or corners of the slabs.

Where division plates have not been used, the partially set concrete shall be cut through to the subgrade. Care shall be taken to make the cut at right angles to the surface of the sidewalk.

The surface edges of each slab shall be rounded to a radius of about one-fourth ($\frac{1}{4}$) in. Markings shall be exactly at cuts between slabs.

X. Expansion Joints.—Expansion joints shall extend from the surface to the subgrade, be truly at right angles to the sidewalk surface and be made by putting the specified joint filler in place before placing the concrete. They shall be placed as follows:

At or near all places where the sidewalk line intersects a curb line or other sidewalk, a one (1) inch expansion joint shall be made at right angles to the center line of the walk.

When the sidewalk fills the space between the curb and the building line, a one-half (½) inch expansion joint shall be placed between the curb and the sidewalk, and between the sidewalk and the building.

A one-half (½) inch expansion joint shall be made across the walk at approximately 50-ft. intervals.

XI. Curing.—As soon as the concrete has set sufficiently, it shall be sprinkled and kept moist until covered. As soon as it can be done without damage to the walk, it shall be covered with two (2) inches of earth or sand which shall be kept wet 7 days. The walk shall then be cleaned and opened to traffic.

The Contractor shall protect the concrete from damage by rain, pedestrians, and animals.

Two-course Construction

The specifications for one-course sidewalks including terms, materials, forms, subgrade, drainage, sub-base, mixing, placing, finishing, jointing and curing shall govern the construction of two-course sidewalks except as noted below.

I. Thickness Proportions.—Two-course sidewalks shall consist of a base four and one-fourth (4¼) inches thick composed of concrete in the proportions one (1) part portland cement, three (3) parts of fine aggregate and five (5) parts coarse aggregate and a top coat three-fourths (¾) of an inch thick composed of mortar in the proportion one (1) part portland cement and two (2) parts fine aggregate.

II. Laying Base.—The base shall be deposited on the subgrade and thoroughly compacted by tamping. It shall then be struck, off by a template which shall leave it nowhere less than three-quarters (¾) of an inch below the finished surface.

III. Laying Wearing Surface.—Within 45 min. after the bottom course is laid and before the initial set has taken place, it shall be covered by the mortar for the top coat.

CONCRETE CURBS AND COMBINED CURB AND GUTTER

I. Definition of Terms.—The term Engineer shall mean the City Engineer, or the authorized representative of the municipality, or of the property owners, appointed to oversee construction.

The term Contractor shall mean the party or parties contracting to do any work described herein, or authorized representative of such party or parties.

II. Sampling and Testing.—Before delivery upon the job and at such other times as the engineer deems necessary, the contractor shall furnish any required samples of the materials hereafter mentioned. Materials shall pass the following requirements:

1. *Cement.*—Cement shall meet the requirements of the current Standard Specifications for portland cement of the American Society for Testing Materials. A 94-lb. sack will be considered 1 cu. ft.

2. *Fine Aggregate.*—Fine aggregate shall consist of natural sand or screenings from hard, tough, crushed rock or gravel consisting of quartz grains or other hard material, clean and free from any surface film or coating and graded from fine to coarse, with the coarse particles predominating. Fine aggregate, when dry, shall pass a screen having four (4) meshes to the linear inch; not more than twenty-five (25) per cent by weight shall pass a sieve having fifty (50) meshes per linear inch, and not more than five (5) per cent by weight shall pass a sieve having one hundred (100) meshes per linear inch. Fine aggregate shall not contain injurious vegetable or other organic matter as indicated by the Colorimetric Test, nor more than three (3) per cent by weight, nor five (5) per cent by dry volume of clay or loam. Field tests may be made by the engineer on fine aggregate as delivered at any time during progress of the work. If there is more than seven (7) per cent of clay or loam by volume in one (1) hour's settlement after shaking in an excess of water, the material represented by the sample shall be rejected.

(*a*) Colorimetric Test of Sand.

Briefly, the Colorimetric Test may be applied in the field as follows: Fill a twelve (12) ounce graduated prescription bottle to the four and one-half (4½) ounce mark with the sand to be tested. Add a three (3) per cent solution of sodium hydroxide until the volume of sand and solution, after shaking, amounts to seven (7) ounces. Shake thoroughly and let stand for twenty-four (24) hours. The sample shall then show a practically colorless solution, or at most a solution not darker than straw color.

Fine aggregate shall be of such quality that mortar composed of one (1) part portland cement and three (3) parts fine aggregate, by weight, when made into briquets, shall show a tensile strength at 7 and 28 days at least equal to the strength of briquets composed one (1) part of the same cement and three (3) parts Standard Ottawa sand, by weight. The percentage of water used in making the briquets of cement and fine aggregate shall be such as to produce a mortar of the same consistency as that of the Ottawa sand briquets of Standard consistency. In other respects all briquets shall be made in accordance with the methods of testing cement recommended by the American Society for Testing Materials. (See Cement Specifications A.S.T.M.).

3. *Coarse Aggregate.*—Coarse aggregate may be pebbles; broken stone or blast furnace slag.

The broken stone or pebbles shall be clean, hard, durable, uncoated rock. It shall contain no vegetable or other deleterious matter and shall be free from all soft, then, elongated or laminated pieces.

Slag shall be air cooled, non-glassy and shall weigh not less than seventy (70) pounds per cubic foot when dry.

One hundred (100) per cent of the coarse aggregate shall pass a one and one-half (1½) inch screen and at least ninety-five (95) per cent shall be retained on a one-quarter (¼) inch screen, with all intermediate sizes retained.

4. *Water.*—Water shall be clean and free from alkali, oil, or acid.

5. *Joint Filler.*—Joint filler shall be premolded strips of bitumen filled fiber or mineral aggregate passing an eighty (80) mesh screen one-half (½) inch thick and of the actual section of the concrete. The consistency shall be such that it will not run in summer or chip out in winter.

6. *Forms.*—Forms shall be of lumber two (2) inches thick, or of steel of equal strength, except on curves where flexible strips may be used. All surfaces coming in contact with the concrete shall be smooth and shall be cleaned and oiled before concrete is placed against them. Face boards for combination curb and gutter shall be beveled as shown on the plans and be held in place with suitable clamps, numerous enough to prevent bulging of the forms.

7. *Division Plates.*—Division plates shall be of one-eighth (⅛) inch steel and shall exactly conform to the cross-section of the concrete shown on the plans, except that a small lug provided with a hole for a hook shall project above the surface of the concrete to aid in removing the plate. Plates shall be cleaned and oiled each time prior to use.

8. *Curb Armor.*—Curb armor shall be the length of the slab upon which it is placed, of the shape known on the plans, fabricated from a good quality of steel and galvanized. The anchors shall extend into the concrete not less than two (2) inches.

Armor bar shall be placed on all curved curbs at intersections and at other points specified in the plans. It shall be inset so that it comes flush with concrete and shall be held in place till the concrete about it has hardened sufficiently to prevent displacement.

III. Subgrade.—That portion of the ground surface directly beneath the concrete shall be called the subgrade.

All soft and spongy material in the subgrade shall be removed and replaced with suitable material. Fills shall be compacted in layers not exceeding six (6) inches in thickness. Spots previously compacted by traffic shall be loosened to a depth of six (6) inches and the whole subgrade shall be compacted to a firm surface having as nearly as possible uniform bearing power. The subgrade shall be damp but not muddy when the concrete is placed upon it.

IV. Drains.—In poorly drained ground where in the opinion of the engineer necessary to save the concrete from damage by frost action drains of four (4) inch tile shall be laid to the lines and grades given by the engineer.

V. Sub-base.—Where drains are impracticable and the soil is heavy colloidal clay, or adobe, a five (5) inch sub-base shall be constructed of cinders, gravel or other porous material approved by the engineer. The sub-base shall be tamped until the surface is firm and of uniform bearing power.

VI. Cross-section Proportions.—The concrete shall have the cross-section shown on the plans. It shall be mixed in the proportion of one (1) part of cement to two and one-half (2½) parts of fine aggregate and not more than four (4) parts of coarse aggregate. Aggregates shall be accurately measured in a manner approved by the engineer.

VII. Length of Sections.—Curb or combined curb and gutter shall be divided into sections ten (10) feet long. Where necessary for closure this length may be varied slightly, but noticeably long or short sections shall not be used.

Sections will be separated by the division plates specified herein which shall be put in the form before the concrete is placed and be kept perpendicular to the face and top of the curb.

Plates shall be withdrawn when the concrete has hardened sufficiently to keep the edges from joining. Edges shall be rounded to a radius of about one-half (½) inch.

VIII. Expansion Joints.—A one-half (½) inch expansion joint shall be made at one hundred (100) foot intervals and at the ends of all curves, by placing the specified joint filler in the form before the concrete is placed. Care shall be exercised to get expansion joints truly perpendicular to the top and face of the curb. The filler must effect a complete separation between adjacent sections of the curb.

IX. Mixing.—The ingredients of the concrete shall be mixed until each particle of the fine aggregate is coated with cement and each particle of the coarse aggregate is coated with mortar.

The mixer used shall be of an approved batch type. Each batch shall be mixed at least one (1) minute from the time all the materials including water are in the drum, until the beginning of the discharge.

The consistency of the concrete shall be such that no separation of the ingredients takes place. No combination of dry and wet mixtures will be allowed.

X. Placing.—When mixed the concrete shall be placed at once in the forms, filling both the apron and curb with material of the same consistency. The concrete shall then be tamped, and spaded until a thin coat of mortar is against the forms and no coarse aggregate will show when the forms are removed.

Whole sections shall be constructed without interruption. Whenever mixing is suspended for forty-five (45) minutes or longer, material in excess of a complete section shall be wasted. No concrete shall be placed when the temperature is below 35°F., or liable to be below 35° in the next 24 hr.

XI. Finishing.—The concrete shall be struck off flush with the top of the forms and be given a true even finish with a wooden float and brush, care being taken that none of the coarse aggregate is exposed.

Corners and edges shall be rounded with suitable tools to the shape shown on the plans.

When the concrete has hardened sufficiently, curb face boards shall be removed and the curb face brushed with a calcimine brush dipped in water. Other forms shall remain in place at least 24 hr.

XII. Curing.—Concrete shall be kept wet for seven (7) days, either by sprinkling, or covering with earth and sprinkling.

XIII. Protection.—The contractor shall protect the concrete from all damage by traffic or the elements by canvas covers, barricades, fences, red lights at night, or such other means as may be necessary, and shall provide cross-covers for pedestrians at all street crossings.

Brick Walks.—Brick walks are used extensively in residential sections and for the business streets of smaller towns.

The preparation of the sub-base is the same as for concrete walks, providing a well drained, graded foundation. Upon this, a sand bed 2 in. thick is placed, and leveled to proper grade for the walk. The bricks are then laid on the sand bed, the men laying the brick standing on the bricks already laid to avoid disturbing the sand bed. The brick is then tamped or rolled to an even surface and covered with a layer of fine sand about ¼ in. thick to be worked into the joints by the traffic. Common building bricks are used, laid flat for light traffic, but a better method is to set the brick on edge and grout the joints with cement mortar.

For a first class durable walk, hard burnt paving brick should be used. Paving bricks are manufactured from either shale or fire clay in a manner similar to that employed in the manufacture of common building bricks. The principal difference is that paving bricks are burned much harder than common bricks. It is easy to distinguish shale bricks from fire-clay bricks by their color as the shale bricks burn to a chocolate or red, while the fire-clay bricks are yellow.

Paving Brick.—There are three types of paving bricks now in use: repressed, wire-cut lug and plain wire-cut (vertical fiber). A repressed brick is first wire-cut and then placed in a repressing machine which smooths it, rounds the edges and adds lugs or projections on one side. A wire-cut lug brick is cut from the column of clay in such a way that the lugs are formed during the cutting. A plain wire-cut brick (vertical fiber) is cut with the sides straight and is laid in the pavement with the wire-cut surface up. It is generally without lugs.

There has been in the past an endless number of sizes manufactured, but at a recent conference of the paving brick manufacturers, the majority of these were eliminated and six sizes retained as standard. They are as follows:

Plain Wire-cut Brick (Vertical Fiber Lugless) (As usually laid)						Wire-cut Lug Brick (Dunn)					
Depth		Width		Length	Number to Square Yard	Depth		Width		Length	Number to Square Yard
3	by	4	by	8½	36	3	by	3½	by	8½	40
3½	by	4	by	8½	36	3½	by	3½	by	8½	40
						4	by	3½	by	8½	40

REPRESSED LUG BRICK

DEPTH		WIDTH		LENGTH	NUMBER TO SQUARE YARD
4	by	3½	by	8½	40

A brick 3½ by 8½ by 4 in. will weigh 10 lb., and one 4 by 8½ by 3 in., 8½ lb. The number of bricks which can be hauled in a load depends on the condition of the roads, but 600 of the 4-in. brick make a good load, as they weigh 3 tons.

Grout.—In grouting brick 4 in. deep with medium joints, one bag of cement and 1 cu. ft. of sand will cover about 8 sq. yd. When the joints are cemented with asphalt, about 12 lb. of asphalt filler is required per square yard.

Labor.—An experienced mechanic will lay about twelve thousand bricks in 8 hr., and it will require 5 or 6 laborers to wheel the bricks if a conveyor is not used. About 2 laborers will be required for spreading, leveling and rolling the sand cushion for each brick layer.

The following are the present market quotations on plain wire-cut paving brick:

	DELIVERED F.O.B.	
	3 IN.	4 IN.
New York City	$46.50	$54.00
Chicago	34.00	42.00
Boston	48.25	56.00

Asphalt Walks.—Asphalt walks consist of a concrete base and a surface layer of mastic made of sand or crushed stone mixed with asphalt. The asphalt has a tendency to check or crack, but being plastic, these cracks are closed again by the action of the traffic. It is not advisable to use asphalt for walks in residential sections unless there is sufficient traffic to keep them in good condition.

Base.—The sub-base and base required are the same as for concrete and brick, but sometimes a surfacing coat of asphalt is put over an old cobble stone, brick, or stone slab pavement. Whichever base is used, it must be thoroughly cleaned and absolutely dry before applying the hot asphalt. If there is any moisture in the base, it will form steam pockets, preventing the asphalt from adhering to the base.

Thickness and Cost.—For foot traffic an asphalt finish 1 in. thick is sufficient. For cost see "Special Floors," page 454.

Stone Slabs.—Stone slab pavements are rather expensive, due to the cost of the stone. They are usually laid on a sand bed smoothed to grade, no base being used.

Stone flagging is quoted in New York at 22 cts. per square foot. Blue Stone curbing 5 by 16 in. is quoted at 80 cts. per lineal foot.

Cinder Walks.—Cinder walks are constructed by excavating a trench about 6 in. deep and filling it with cinders. These are wetted, tamped and rolled similar to the base for concrete walks. Considerable crown is necessary and also small gutters at the side to provide proper drainage.,

Macadam and gravel walks consist of a layer of broken stone about 3 or 4 in. thick, thoroughly compacted with heavy rollers in a trench 5 in. deep. The surface coat consists of fine gravel or torpedo sand. The surface should be about ½ in. below the adjoining lawn. The labor required is about the same as for the sub-base for concrete.

Asphalt Tile.—Asphalt paving tiles are made of asphaltic cement and crushed stone. They are made 8 in. square by 2½ in. thick or hexagonal with an equal area and the same thickness. They are laid on a sand bed 2 in. thick over a concrete base about 4 in. thick, similar to brick walks.

The cost of asphalt tile is approximately 30 cts. per square foot. A mechanic and a helper will lay 100 sq. ft. in 2 hr.

CHAPTER XXVIII

APPRAISAL OF BUILDINGS

By use of the data in this chapter it is easy to estimate the cost to reproduce almost any building constructed since 1890 of which the original cost is known. The method of using the tables is fully explained on page 651. Their use is so simple that no extensive study of the methods used in their production is necessary to enable one to use them quickly and accurately. While there are but nine types of buildings carried out in the tables, these types are broad enough so that any ordinary building can safely be fitted into one of them. The only requisite necessary to enable the data to be used for a given building is that the major portion of the material in the building be similar to the material in the type building used for the curve, and that the ratio between the cost of material and the cost of labor in the two buildings be approximately the same. Thus the curve for the frame passenger station on page 653 has been used for a frame dwelling, and by careful checking found entirely satisfactory. Likewise the curve made for a brick station on page 653 would give satisfactory results for a brick dwelling because the kinds of material of which they are constructed are very much alike and the ratio in each case between the labor and material are practically the same. By this method it is possible by a little consideration and study to determine with a reasonable degree of accuracy the cost to reproduce almost any building at the present time.

Uses for the Cost of Reproduction New.—It seems to be the opinion of the Interstate Commerce Commission and apparently also of the Supreme Court that the present value of a building, or even of an entire business is the cost of reproduction new less depreciation, plus a *going concern* value. This being the case, a quick and reasonably accurate method of determining the cost of reproduction new of buildings is a vital step in any valuation or appraisal work.

There are many reasons for wishing to know the present value of buildings besides that of appraisal. It is the basis for fair dealing in

the case of purchase or sale, and in many instances also of rental. This knowledge is essential in determining the proper amount of insurance that should be carried. The present value is also required when adjusting an insurance loss in the case of fire. Another constantly recurring case for which the cost of reproduction new of buildings is needed is the adjusting of taxes. When new buildings are to be constructed similar to others already in use, this information will enable one to determine at once and with accuracy what the new buildings should cost. These are only a few of the many reasons for wishing to know the present value of buildings.

Reliability of Tables.—These tables were produced with the greatest possible degree of accuracy and required a large amount of painstaking effort. The labor to collect the data alone required a force of some 15 men for about 6 months' time, while the supervision, committee meetings and search for data, required the traveling of not less than 25,000 miles. The results of all this study have been put in handy table and chart form for use and are all given in this chapter. The mass of underlying data from which the tables were prepared would make a good sized volume by itself. These data being so bulky, of course could not be included in this book.

Types of Buildings Included.—The information in this chapter covers the following types of buildings: Frame passenger stations, brick passenger stations, modern office buildings, frame shop buildings, brick shop building with wood framing, brick shop buildings with steel framing, pier sheds with wood framing, pier sheds with steel framing and reinforced concrete warehouses.

In addition to the above types of buildings, trend lines were prepared for the following building items: Steelwork, masonry chimneys, plumbing, heating, lighting and elevators.

Method of Preparing the Data.—(1) The average rate of wages paid to the various kinds of building labor during each of the several years to be covered by the report was determined.

2. Lists of unit prices were prepared for all the major kinds of building materials for the same years.

3. These material and labor prices were combined in such a way as to prepare tables and charts showing the variation in costs year by year for each type of structure treated.

In making a study of the rate of wages in the building trades, it was found that reliable information could only be obtained from the

years 1890 to the present date. Therefore, it was decided to prepare trend lines covering only this period. In order to make the work as universally applicable as possible, a list was made of the cities forming the principal labor markets in the eastern part of the United States. This resulted in the selection of the following fourteen cities: Albany, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, New York, Philadelphia, Pittsburgh, Rochester, St. Louis, Scranton and Washington. The rates of wages paid in these cities were used in determining the average rate of wages to be applied. These rates of wages were obtained from reliable sources such as the statistics of the U. S. Department of Labor and tables published by the Builders' Association of Chicago.

Unit prices and price trends of some building materials were obtained from the following periodicals and bulletins: the *Iron Age*, *Bull. No.* 269—*U. S. Department of Labor, Metal Statistics*, *New York Lumber Trade Journal* and similar sources Other prices were obtained by taking an average of the record prices applied in valuation work by the roads of the New York-Pittsburgh group. An average of these prices for the year 1914 was used as a base, and the price trends applied to this base to obtain prices for other years. In every instance, the method followed in arriving at the cost of any material for the various years was the one considered to be the most accurate for the particular material in question, and was adopted only after reviewing all available sources of information.

The labor and the material prices were then combined in such a way as to show the variation in cost of reproduction new for each of the several types of buildings treated. This was done by making a complete bill of material for a typical building in each type of structure. These bills of material were separated into their component parts of labor hours and quantity of material. For instance, brickwork was divided into common brick, face brick, cement, lime and sand, as well as labor hours for masons, hod carriers, etc. All other construction items were similarly handled. A summary was next made showing the total amount of each kind of material and labor, which was tabulated for pricing. Unit prices were then applied and a total cost obtained for each year.

Method of Using the Tables.—In preparing the tables the cost of buildings for the year 1914 was considered as the base price or as 100 per cent and the cost for any other year as a percentage of this

base. In order therefore to estimate the cost to reproduce a building at the present time by the use of the tables, it is necessary first to bring its original cost to the equivalent cost for the year 1914. Then from the 1914 cost the cost at the present time is determined. The 1914 cost can be obtained from the original cost by dividing the original cost by the percentage given for the year in which the building was constructed. A simpler method, however, is to multiply the original cost by the reciprocal of the percentage for the year in question. For convenience the reciprocals have been figured and will be found in the tables opposite the percentages. Having thus determined the cost as of 1914, the cost at the present time can be found by multiplying the cost for the year 1914 by the percentage for the present year.

Example: If a brick shop building with wooden roof trusses was built in the year 1900 and cost $20,000, what would it cost to build a similar building in the year 1923? Referring to the table for "Brick Shop with Wooden Trusses" it will be seen that the percentage for the year 1900 is 80.4 and the reciprocal is 1.244. Therefore the cost to construct this building in 1914 would have been $20,000 times 1.244 or $24,880. Again referring to the table, it will be seen that this type of building in 1923 cost 227.7 per cent as much as it did in 1914. Therefore the cost to construct the building in question in 1923 would be 227.7 per cent of its cost in 1914, or $24,880 times 2.277 which equals $56,651.76.

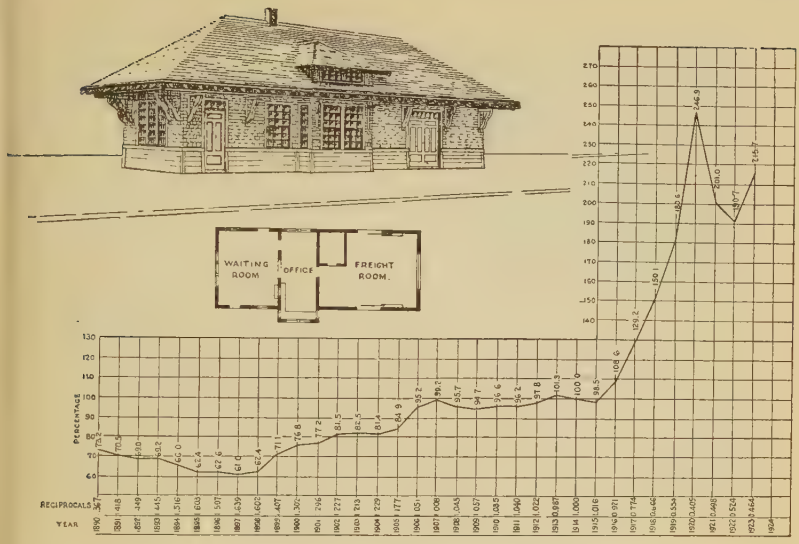


FIG. 1.—Frame passenger station.

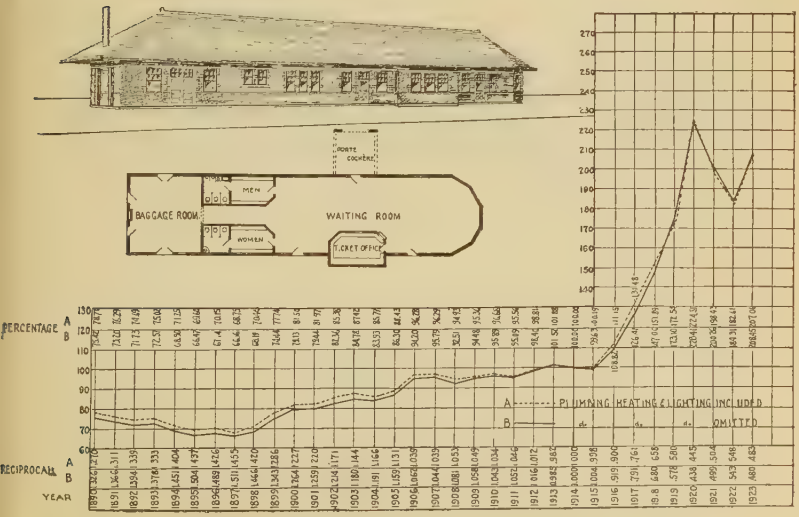


FIG. 2.—Brick passenger station.

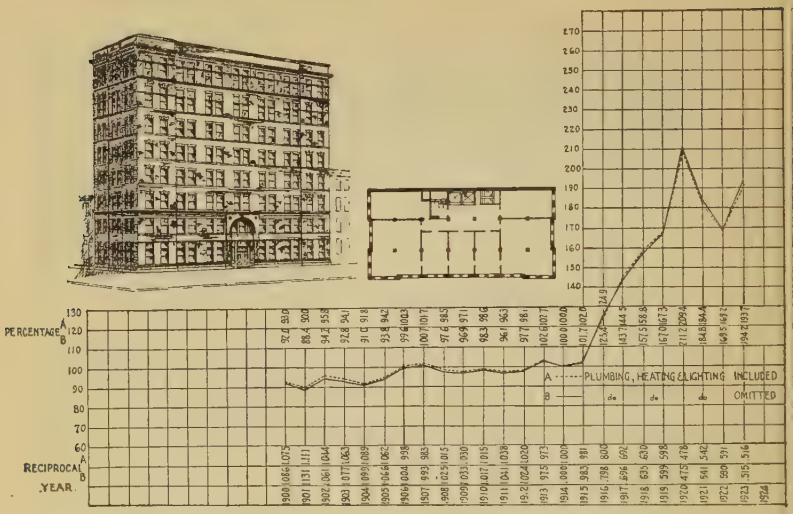


FIG. 3.—Fireproof office building.

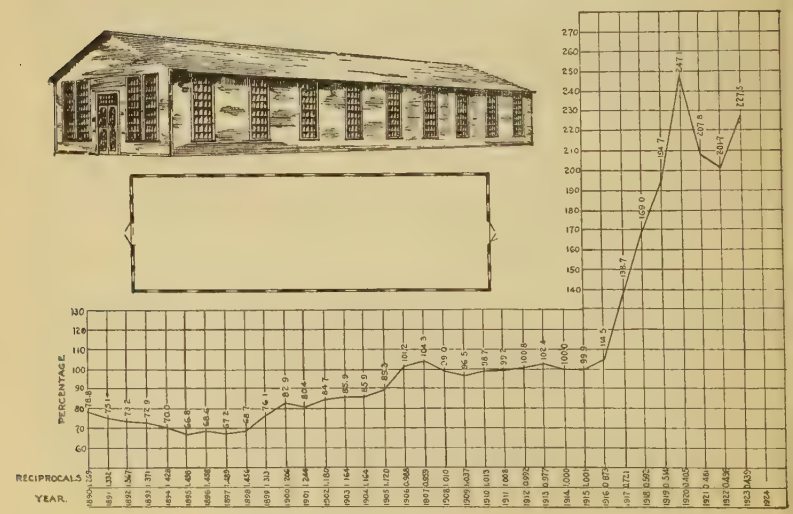


FIG. 4.—Frame shop.

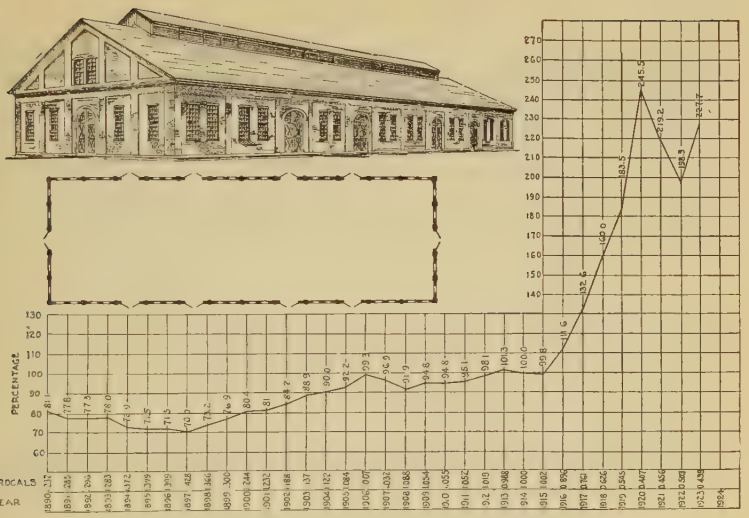


FIG. 5.—Brick shop with wooden trusses.

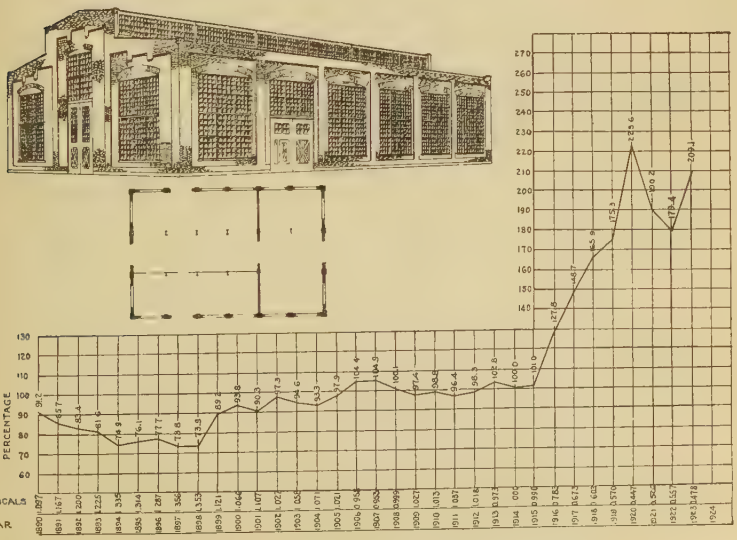


FIG. 6.—Brick shop with steel roof trusses.

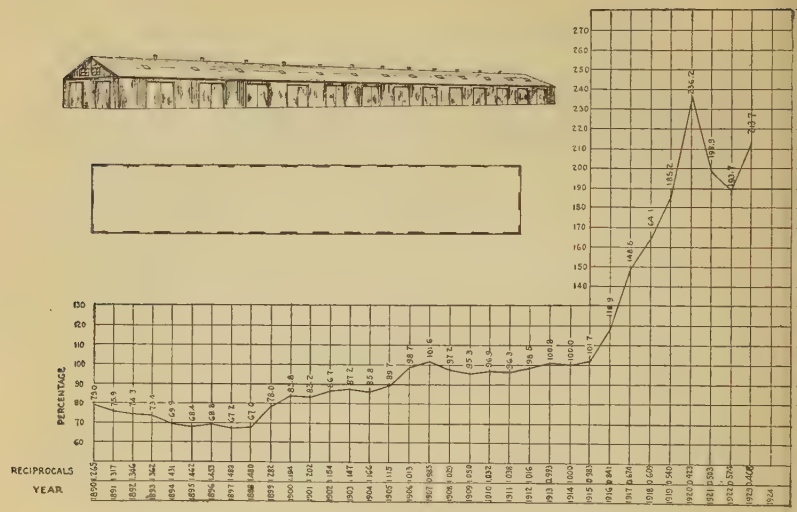


FIG. 7.—Corrugated iron pier shed with wood trusses.

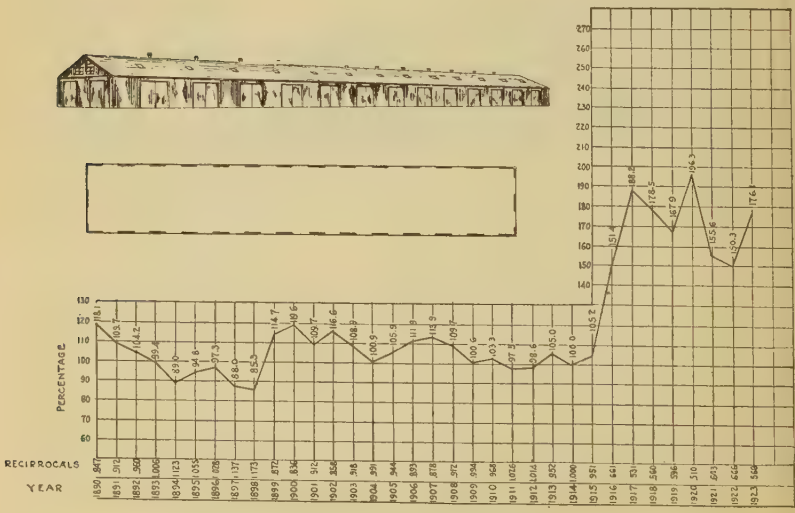


FIG. 8.—Corrugated iron pier shed with steel frame.

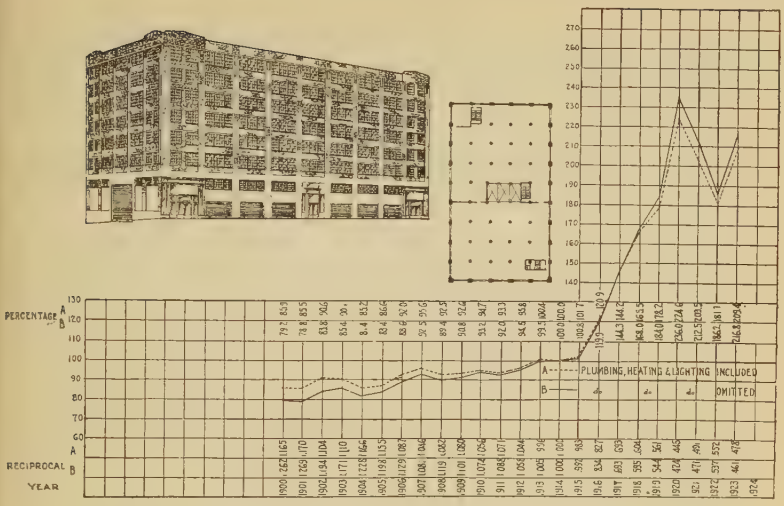


FIG. 9.—Reinforced concrete warehouse.

VOLUME, TOTAL COST AND COST PER CUBIC FOOT IN 1923 FOR THE VARIOUS BUILDINGS

Structure	Volume in cu. ft.	Total cost	Cost per cu. ft.
Frame passenger station	24,467	$ 4,892	$.200
Brick passenger station	87,622	22,937	.262
Office building	953,098	355,027	.372
Frame shop wood roof trusses	154,512	14,348	.093
Brick shop wood frame	697,720	51,238	.073
Brick shop steel frame	321,817	39,301	.122
Pier shed timber truss	1,341,900	55,880	.042
Pier shed steel frame	2,921,742	85,867	.029
Reinforced concrete warehouse	1,894,430	437,631	.231

RECIPROCALS

Year	Frame passenger station	Brick passenger station, plumbing, heating and lighting omitted	Brick passenger station, plumbing, heating and lighting included	Office building, plumbing, heating, lighting and elevators omitted	Office building, plumbing, heating, lighting and elevators included	Frame shop building	Brick shop, wood frame	Brick shop, steel frame	Pier shed, wood frame
1890	1.367	1.326	1.270	.....	.....	1.269	1.232	1.097	1.265
1891	1.418	1.366	1.311	.....	.....	1.332	1.285	1.167	1.317
1892	1.449	1.394	1.339	.....	.....	1.367	1.296	1.200	1.346
1893	1.445	1.378	1.333	.....	.....	1.371	1.283	1.225	1.362
1894	1.516	1.451	1.404	.....	.....	1.428	1.372	1.335	1.431
1895	1.603	1.504	1.437	.....	.....	1.498	1.399	1.314	1.462
1896	1.597	1.489	1.426	.....	.....	1.458	1.399	1.287	1.453
1897	1.639	1.511	1.455	.....	.....	1.489	1.428	1.356	1.488
1898	1.602	1.466	1.420	.....	.....	1.456	1.366	1.353	1.480
1899	1.407	1.343	1.286	.....	.....	1.313	1.300	1.121	1.282
1900	1.302	1.264	1.227	1.086	1.075	1.206	1.244	1.066	1.194
1901	1.296	1.259	1.220	1.131	1.111	1.244	1.232	1.107	1.202
1902	1.227	1.214	1.171	1.061	1.044	1.180	1.188	1.027	1.154
1903	1.213	1.180	1.144	1.077	1.063	1.164	1.137	1.058	1.147
1904	1.229	1.191	1.166	1.099	1.089	1.164	1.122	1.071	1.166
1905	1.177	1.159	1.131	1.066	1.062	1.120	1.084	1.021	1.115
1906	1.051	1.062	1.039	1.004	0.998	0.988	1.007	0.958	1.013
1907	1.008	1.044	1.039	0.993	0.983	0.959	1.032	0.953	0.985
1908	1.045	1.081	1.053	1.025	1.015	1.010	1.088	0.999	1.029
1909	1.057	1.058	1.049	1.033	1.030	1.037	1.054	1.027	1.050
1910	1.035	1.043	1.034	1.017	1.015	1.013	1.055	1.013	1.032
1911	1.040	1.052	1.046	1.041	1.038	1.008	1.052	1.037	1.038
1912	1.022	1.016	1.012	1.024	1.020	0.992	1.019	1.018	1.016
1913	0.987	0.985	0.982	0.975	0.973	0.977	0.988	0.973	0.993
1914	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1915	1.016	1.004	0.998	0.983	0.981	1.001	1.002	0.990	0.983
1916	0.921	0.919	0.900	0.798	0.800	0.873	0.896	0.783	0.841
1917	0.774	0.791	0.761	0.696	0.692	0.721	0.761	0.673	0.674
1918	0.666	0.680	0.658	0.635	0.630	0.592	0.626	0.603	0.609
1919	0.554	0.578	0.580	0.599	0.598	0.514	0.545	0.570	0.540
1920	0.405	0.438	0.445	0.475	0.478	0.405	0.407	0.447	0.423
1921	0.498	0.499	0.504	0.541	0.542	0.481	0.456	0.526	0.503
1922	0.524	0.543	0.548	0.590	0.591	0.496	0.503	0.557	0.524
1923	0.464	0.480	0.483	0.515	0.516	0.439	0.439	0.478	0.468

RECIPROCALS.—(*Continued*)

Year	Pier shed, steel frame	Reinforced concrete warehouse, plumbing, heating, lighting and elevators omitted	Reinforced concrete warehouse, plumbing, heating, lighting and elevators included	Radial brick chimneys	Plumbing, except toilet building	Plumbing, toilet building	Heating	Electric light passenger station	Electric light, shop building	Electric elevators
1890	0.847	.....	.....	.....	.....	.....	1.074			
1891	0.912	.....	.....	.....	.....	.....	1.145			
1892	0.960	.....	.....	.....	.....	.....	1.198			
1893	1.006	.....	.....	.....	.....	.....	1.250			
1894	1.123	.....	.....	.....	.....	.....	1.374			
1895	1.055	.....	.....	.....	.....	.....	1.312			
1896	1.028	.....	.....	.....	.....	.....	1.313			
1897	1.137	.....	.....	.....	.....	.....	1.421			
1898	1.173	.....	.....	.....	.....	.....	1.419			
1899	0.872	.....	.....	.....	.....	.....	1.093			
1900	0.836	1.262	1.165	1.200	1.067	1.072	1.106	0.995	0.932	0.896
1901	0.912	1.269	1.170	1.176	1.081	1.085	1.074	0.995	0.932	0.904
1902	0.858	1.194	1.104	1.153	1.070	1.077	0.976	0.995	0.932	0.857
1903	0.918	1.171	1.110	1.133	1.036	1.043	0.986	0.995	0.932	0.951
1904	0.991	1.228	1.166	1.101	1.047	1.050	1.081	0.995	0.932	1.012
1905	0.944	1.198	1.155	1.072	1.027	1.033	1.010	1.015	0.950	1.091
1906	0.893	1.129	1.087	1.044	1.001	1.009	0.927	0.895	0.851	1.033
1907	0.878	1.081	1.046	1.062	0.955	0.963	0.872	0.892	0.848	1.015
1908	0.912	1.119	1.082	1.034	0.999	1.002	0.924	0.897	0.867	1.038
1909	0.994	1.101	1.080	1.026	1.031	1.034	1.003	0.954	0.923	1.056
1910	0.968	1.074	1.056	1.021	0.992	0.995	1.014	0.927	0.918	1.028
1911	1.026	1.088	1.071	1.017	1.017	1.019	1.035	0.979	0.966	1.039
1912	1.014	1.058	1.044	1.008	0.999	1.002	0.993	0.973	0.970	1.017
1913	0.952	1.005	0.996	1.000	0.983	0.985	0.959	0.956	0.953	0.975
1914	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1915	0.951	0.992	0.983	1.000	0.970	0.977	0.978	0.951	0.954	0.951
1916	0.661	0.834	0.827	1.008	0.905	0.913	0.773	0.868	0.847	0.796
1917	0.531	0.693	0.693	0.983	0.796	0.814	0.574	0.729	0.775	0.716
1918	0.560	0.595	0.604	0.876	0.781	0.796	0.495	0.638	0.701	0.659
1919	0.596	0.544	0.561	0.706	0.739	0.746	0.554	0.510	0.578	0.638
1920	0.510	0.424	0.445	0.690	0.525	0.529	0.459	0.531	0.551	0.540
1921	0.643	0.471	0.491	0.745	0.469	0.468	0.538	0.626	0.631	0.589
1922	0.666	0.537	0.552	.....	0.487	0.485	0.595	0.732	0.717	0.608
1923	0.568	0.461	0.478	.....	0.445	0.446	0.503	0.644	0.636	0.544

BRICKLAYERS

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.400N	0.466A	0.398A	0.359A	0.500A	0.495A	0.425A	0.471A	0.447A	0.468A	0.350N	0.481A	.....	0.505A	0.443
1891	.....	0.475A	0.427A	0.359A	0.500A	0.504A	0.450A	0.473A	0.450A	0.470A	0.350N	0.478A	.....	0.500A	0.451
1892	.....	0.461A	0.431A	0.360A	0.500A	0.505A	0.450A	0.500A	0.449A	0.450A	0.350N	0.463A	.....	0.500A	0.452
1893	.....	0.432A	0.441A	0.360A	0.500A	0.500A	0.450A	0.500A	0.450A	0.429A	0.350N	0.450A	.....	0.500A	0.447
1894	0.450N	0.387A	0.450A	0.360A	0.500A	0.563A	0.450A	0.500A	0.450A	0.372A	0.350N	0.493A	.....	0.500A	0.448
1895	0.450N	0.354A	0.448A	0.360A	0.500A	0.563A	0.450A	0.500A	0.450A	0.371A	0.400N	0.491A	.....	0.500A	0.449
1896	0.450N	0.340A	0.449A	0.360A	0.500A	0.550A	0.450A	0.500A	0.449A	0.400A	0.400N	0.502A	.....	0.500A	0.450
1897	0.450M	0.340A	0.457A	0.360A	0.500A	0.453A	0.450A	0.500A	0.448A	0.400A	0.400N	0.504A	.....	0.500A	0.443
1898	0.450M	0.340A	0.466A	0.360A	0.500A	0.450A	0.450A	0.550A	0.403A	0.400A	0.400N	0.457A	.....	0.500A	0.437
1899	0.450M	0.362A	0.474A	0.371A	0.500A	0.473A	0.450A	0.500A	0.463A	0.470A	0.400N	0.533A	.....	0.500A	0.461
1900	0.450M	0.362A	0.479A	0.405A	0.500A	0.500A	0.450A	0.562A	0.494A	0.500A	0.400N	0.550A	.....	0.500A	0.473
1901	0.500M	0.392A	0.504A	0.450A	0.500A	0.518A	0.500A	0.590A	0.497A	0.600A	0.450N	0.550A	.....	0.563A	0.509
1902	0.500M	0.501A	0.502A	0.500A	0.550A	0.563A	0.536A	0.648A	0.550A	0.600A	0.470N	0.582A	.....	0.563A	0.543
1903	0.500M	0.568A	0.525A	0.500A	0.600A	0.560A	0.528A	0.650A	0.600A	0.600A	0.500N	0.642A	.....	0.563A	0.564
1904	0.500C	0.640C	0.536C	0.500C	0.600C	0.600C	0.500C	0.650C	0.600C	0.600C	0.500C	0.658C	0.500C	0.563C	0.568
1905	0.500C	0.660C	0.550C	0.500C	0.630C	0.617C	0.550C	0.700C	0.600C	0.650C	0.530C	0.702C	0.500C	0.625C	0.594
1906	0.494D	0.637D	0.589D	0.550D	0.622D	0.621D	0.600D	0.700D	0.625D	0.617D	0.530D	0.737D	0.500D	0.625D	0.604
1907	0.579D	0.625E	0.596E	0.550E	0.626E	0 600E	0.600E	0.700E	0.625E	0 600E	0.570D	0.650D	0.550E	0.625E	0.607
1908	0.600M	0.625E	0.600E	0.550E	0.625E	0.600E	0.600E	0.700E	0.625E	0.650E	0.570N	0.650E	0.550E	0.625E	0.612
1909	0.600B	0.325E	0 600E	0.550E	0.675E	0.600E	0.600E	0.700E	0.625E	0.650E	0.570B	0.650E	0.550E	0 625E	0.616
1910	0.600B	0.625E	0.600E	0 600E	0.675E	0 625E	0.625E	0.700E	0.625E	0.650E	0.600B	0.700E	0.550E	0.625E	0.629
1911	0.600B	0.625E	0 600E	0 600E	0.675E	0.625E	0.625E	0.700E	0.625E	0.650E	0.600B	0.700E	0.550E	0.625E	0.629
1912	0.600B	0.625E	0.600E	0.600E	0.725E	0.650E	0.650E	0.700E	0.625E	0.650E	0.600B	0.700E	0.550E	0.625E	0.636
1913	0.650B	0.625K	0.650K	0.650K	0.750K	0.650K	0.650K	0.700K	0.625K	0.700K	0.650B	0.700E	0.600K	0 625K	0.659
1914	0.650B	0.625F	0.650F	0.650F	0.750F	0 650F	0.700F	0.750F	0.650F	0.700F	0.650L	0.750F	0 600F	0.667F	0.674
1915	0.650B	0.700L	0.650L	0.650L	0.750L	0.700L	0.700L	0.750L	0.650L	0 700L	0 650L	0.750L	0.600L	0.667L	0.683
1916	0.650B	0.700G	0.650G	0.650G	0.750G	0.700G	0.700G	0.750G	0.650G	0.700G	0.675G	0.750G	0.650G	0 700G	0.691
1917	0.700B	0.750H	0.700H	0.700H	0.750H	0 750H	0.800H	0.750K	0.700H	0.750H	0.700H	0.850H	0.700H	0.700H	0.736
1918	0.700B	0.750I	0.800I	0.750I	0 750I	0.900I	0 900I	0.813I	0.800I	0.900I	0.700I	0.850I	0.750I	0 750I	0.794
1919	0.875B	1.000L	0.900J	0.850J	0.875J	0.900J	1.000J	0.875J	0.875J	1.000J	0.875J	1.000J	0.750J	0.875J	0 904
1920	1.125B	1.250P	1.000P	1.000P	1.250P	1.250P	1.250P	1.250P	1.300P	1.125P	1.500P	1.250P	1.125P	1.000P	1.166
1921	1.125B	1.250Q	1.000Q	1.000Q	1.250Q	1.250Q	1.250Q	1.250Q	1.300Q	1.500Q	1.250Q	1.250Q	1.250Q	1.250Q	1.227
1922	1.000B	1.250B	1.125B	1.000B	1.100B	1.250B	1.250B	1.250B	1.000B	1.300B	1.063B	1.250B	1.250B	1.250B	1.167
1923	1.250B	1.250B	1.250B	1.250B	1.250B	1.250B	1.400B	1.500B	1.438B	1.400B	1.250B	1 500B	1 375B	1 313B	1.325

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.280N	0.260A	0.300A	0.234A	0.350A	0.275A	0.233A	0.431A	0.295A	0.307A	0.239A	0.305A	.....	.....	0.292
1891	.....	0.264A	0.301A	0.233A	0.350A	0.292A	0.254A	0.435A	0.298A	0.305A	0.237A	0.306A	.....	.....	0.298
1892	.....	0.260A	0.303A	0.233A	0.350A	0.311A	0.268A	0.436A	0.299A	0.303A	0.233A	0.324A	.....	.....	0.302
1893	.....	0.271A	0.304A	0.233A	0.350A	0.310A	0.277A	0.433A	0.298A	0.301A	0.252A	0.357A	.....	.....	0.308
1894	0.300N	0.274A	0.305A	0.227A	0.350A	0.326A	0.262A	0.435A	0.300A	0.273A	0.230A	0.360A	.....	.....	0.303
1895	0.300N	0.264A	0.303A	0.220A	0.350A	0.283A	0.238A	0.433A	0.298A	0.260A	0.239A	0.350A	.....	.....	0.295
1896	0.300N	0.264A	0.303A	0.218A	0.350A	0.283A	0.255A	0.436A	0.298A	0.264A	0.243A	0.350A	.....	.....	0.297
1897	0.300N	0.263A	0.303A	0.218A	0.350A	0.274A	0.260A	0.437A	0.296A	0.276A	0.236A	0.350A	.....	.....	0.297
1898	0.333N	0.263A	0.305A	0.228A	0.375A	0.258A	0.276A	0.438A	0.314A	0.267A	0.276A	0.350A	.....	.....	0.307
1899	0.333N	0.273A	0.305A	0.237A	0.425A	0.270A	0.281A	0.451A	0.311A	0.281A	0.285A	0.325A	.....	.....	0.315
1900	0.333N	0.276A	0.335A	0.292A	0.450A	0.296A	0.340A	0.495A	0.343A	0.333A	0.298A	0.383A	.....	.....	0.348
1901	0.344N	0.280A	0.338A	0.324A	0.450A	0.323A	0.348A	0.497A	0.347A	0.364A	0.313A	0.410A	.....	.....	0.361
1902	0.343N	0.294A	0.337A	0.340A	0.450A	0.356A	0.366A	0.514A	0.392A	0.433A	0.310A	0.424A	.....	0.500B	0.389
1903	0.343N	0.368A	0.349A	0.353A	0.500A	0.357A	0.400A	0.561A	0.400A	0.437A	0.339A	0.532A	.....	0.438N	0.414
1904	0.307C	0.374C	0.374C	0.375C	0.500C	0.379C	0.400C	0.530C	0.400C	0.438C	0.345C	0.523C	0.302C	0.438C	0.406
1905	0.324C	0.413C	0.383C	0.375C	0.500C	0.404C	0.422C	0.542C	0.400C	0.438C	0.375C	0.550C	0.345C	0.500C	0.427
1906	0.335D	0.409D	0.405D	0.402D	0.550D	0.402D	0.441D	0.575D	0.450D	0.438D	0.379D	0.550D	0.343D	0.500D	0.441
1907	0.355D	0.423D	0.424D	0.402D	0.563D	0.453D	0.446D	0.607D	0.462D	0.492D	0.401D	0.596D	0.385D	0.500D	0.465
1908	0.375N	0.438E	0.438E	0.400E	0.563E	0.450E	0.450E	0.625E	0.450E	0.500E	0.406N	0.550E	0.375E	0.500E	0.466
1909	0.406N	0.438E	0.473E	0.400E	0.563E	0.450E	0.450E	0.625E	0.450E	0.500E	0.438N	0.600E	0.375E	0.500E	0.477
1910	0.406N	0.438E	0.500E	0.450E	0.600E	0.500E	0.450E	0.625E	0.500E	0.500E	0.438N	0.600E	0.425E	0.500E	0.495
1911	0.450N	0.438E	0.500E	0.450E	0.600E	0.500E	0.450E	0.625E	0.500E	0.500E	0.447N	0.625E	0.425E	0.500E	0.500
1912	0.450N	0.438E	0.500E	0.500E	0.650E	0.500E	0.450E	0.625E	0.500E	0.500E	0.479N	0.625E	0.425E	0.500E	0.509
1913	0.500N	0.438K	0.500K	0.500K	0.650K	0.500K	0.500K	0.625K	0.500K	0.550K	0.500N	0.625K	0.425K	0.500K	0.522
1914	0.500N	0.438F	0.550F	0.500F	0.650F	0.500F	0.550F	0.625L	0.550F	0.563F	0.500L	0.625F	0.475F	0.500F	0.538
1915	0.500N	0.438L	0.550L	0.500L	0.650L	0.550L	0.550L	0.625L	0.550L	0.625L	0.500L	0.625L	0.475L	0.550L	0.549
1916	0.500N	0.438G	0.570G	0.500G	0.700G	0.600G	0.600G	0.625G	0.550G	0.625G	0.531G	0.625G	0.500G	0.550G	0.565
1917	0.563N	0.500H	0.650H	0.625H	0.700H	0.625H	0.700H	0.688H	0.600H	0.710H	0.563H	0.650H	0.500H	0.625H	0.621
1918	0.650N	0.625J	0.750I	0.700I	0.700J	0.650J	0.800J	0.688J	0.700I	0.710I	0.600I	0.700J	0.600I	0.625J	0.678
1919	0.750N	0.800J	0.750J	0.700J	0.800J	0.700J	0.850J	0.750J	0.800J	0.800J	0.800J	0.825J	0.700J	0.875J	0.779
1920	1.000B	0.900P	1.000P	1.000P	1.250P	1.000P	1.250P	1.125P	1.125P	0.900P	1.000P	1.000P	0.875P	0.950P	1.027
1921	1.000B	0.900Q	1.000Q	0.875Q	1.250Q	1.000Q	1.250Q	1.125Q	1.125Q	1.250Q	1.000B	1.250Q	0.875Q	1.050Q	1.068
1922	0.788B	0.800B	1.000B	0.813B	1.000B	0.950B	1.040B	1.125B	0.900B	1.125B	0.850B	1.000B	0.875B	1.050B	0.958
1923	1.000B	0.900B	1.050B	1.000B	1.150B	1.100B	1.250B	1.125B	1.063B	1.200B	1.000B	1.250B	1.000B	1.125B	1.087

ELECTRICIANS (INSIDE)

Wage in dollars per hour

Year (1)	Albany (2)	Balti-more (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincin-nati (7)	Cleve-land (8)	New York (9)	Phila-delphia (10)	Pitts-burgh (11)	Roches-ter (12)	St. Louis (13)	Scran-ton (14)	Washing-ton (15)	Aver-age (16)
1890	0.265AA	0.226AA	0.265AA	0.265AA	0.265AA	0.265AA	0.265AA	0.265AA	0.265AA	0.265AA	0.265AA	0.265AA	0.265AA	0.226AA	0.260
1891	0.266AA	0.218AA	0.266AA	0.266AA	0.267AA	0.267AA	0.267AA	0.266AA	0.266AA	0.266AA	0.266AA	0.267AA	0.266AA	0.218AA	0.259
1892	0.274AA	0.217AA	0.274AA	0.274AA	0.276AA	0.276AA	0.276AA	0.274AA	0.274AA	0.274AA	0.274AA	0.276AA	0.274AA	0.216AA	0.266
1893	0.292AA	0.217AA	0.292AA	0.292AA	0.310AA	0.310AA	0.310AA	0.292AA	0.292AA	0.292AA	0.292AA	0.310AA	0.202AA	0.217AA	0.287
1894	0.289AA	0.213AA	0.289AA	0.289AA	0.301AA	0.301AA	0.301AA	0.289AA	0.289AA	0.289AA	0.289AA	0.301AA	0.289AA	0.213AA	0.282
1895	0.302AA	0.218AA	0.302AA	0.302AA	0.316AA	0.316AA	0.316AA	0.302AA	0.302AA	0.302AA	0.302AA	0.316AA	0.302AA	0.218AA	0.294
1896	0.300AA	0.229AA	0.300AA	0.300AA	0.345AA	0.345AA	0.345AA	0.300AA	0.300AA	0.300AA	0.300AA	0.345AA	0.300AA	0.229AA	0.303
1897	0.328AA	0.228AA	0.328AA	0.328AA	0.345AA	0.345AA	0.345AA	0.328AA	0.328AA	0.328AA	0.328AA	0.345AA	0.323AA	0.228AA	0.318
1898	0.338AA	0.242AA	0.338AA	0.338AA	0.367AA	0.367AA	0.367AA	0.338AA	0.338AA	0.338AA	0.338AA	0.367AA	0.338AA	0.242AA	0.333
1899	0.344AA	0.242AA	0.344AA	0.344AA	0.365AA	0.365AA	0.365AA	0.344AA	0.344AA	0.344AA	0.344AA	0.365AA	0.344AA	0.242AA	0.336
1900	0.396AA	0.275AA	0.396AA	0.396AA	0.359AA	0.359AA	0.359AA	0.396AA	0.396AA	0.396AA	0.396AA	0.359AA	0.396AA	0.275AA	0 368
1901	0.380AA	0.278AA	0.380AA	0.380AA	0.373AA	0.373AA	0.373AA	0.380AA	0.380AA	0.380AA	0.380AA	0.373AA	0.380AA	0.278AA	0.363
1902	0.402AA	0.292AA	0.402AA	0.402AA	0.397AA	0.397AA	0.397AA	0.402AA	0.402AA	0.402AA	0.402AA	0.3y7AA	0.402AA	0.292AA	0.385
1903	0.434AA	0.326AA	0.434AA	0.434AA	0.454AA	0.454AA	0.454AA	0.434AA	0.434AA	0 434AA	0.431AA	0.454AA	0.434AA	0.326AA	0.424
1904	0.416CC	0.314CC	0.416CC	0.416CC	0.387CC	0.387CC	0.387CC	0.416CC	0.416CC	0.416CC	0.416CC	0.387CC	0.416CC	0.314CC	0.393
1905	0.417CC	0.333CC	0.417CC	0.417CC	0.433CC	0.433CC	0.433CC	0.417CC	0.416CC	0.417CC	0.416CC	0.433CC	0.417CC	0.333CC	0.409
1906	0.335D	0.433D	0.450D	0.379D	0.563D	0.386D	0.450D	0.503D	0.381D	0.500N	0.344N	0.563D		0.500	0.445
1907	0.339D	0.438E	0.450E	0.375E	0.625E	0.406E	0.450E	0.500E	0.450E	0.500E	0.344N	0.650E	0.313E	0.500E	0.453
1908	0.375N	0.438E	0.450E	0.375E	0.625E	0.406E	0.475E	0.563E	0.450E	0.500E	0.406N	0.650E	0.313E	0.500E	0.466
1909	0.375M	0.438E	0.450E	0.375E	0.688E	0.406E	0.500E	0.563E	0.450E	0.500E	0.406B	0.650E	0.313E	0.500E	0.472
1910	0.375M	0.438E	0.500E	0.400E	0.688E	0.406E	0.525E	0.563E	0.450E	0.500E	0.438B	0.650E	0.469E	0.500E	0.493
1911	0.375B	0.438E	0.500E	0.400E	0.750E	0.450E	0.550E	0.563E	0.450E	0.500E	0.438B	0.650E	0.469E	0.500E	0.502
1912	0.375B	0.438E	0.550E	0.400E	0.750E	0.450E	0.570E	0.563E	0.450E	0.500E	0.469B	0.650E	0.469E	0.500E	0.510
1913	0.600B	0.438K	0.550K	0.450K	0.750K	0.500K	0.575K	0.563K	0.450K	0.575K	0.500B	0.650K	0.460K	0.550K	0.540
1914	0.590B	0.438F	0.550F	0.475F	0.750F	0.500F	0.600F	0.600F	0.450F	0.575F	0.500L	0.675F	0.469F	0.500F	0.549
1915	0.500B	0.438L	0.600L	0.509L	0.750L	0.531L	0.688L	0.600L	0.450L	0.575L	0.500L	0.750L	0.469L	0.600L	0.568
1916	0.500B	0.438G	0.625G	0.563G	0.750G	0.563G	0.700G	0.600G	0.500G	0.625G	0.531G	0.750G	0.500G	0.600G	0.589
1917	0.563B	0.500H	0.650H	0.625H	0.750H	0.625H	0.750H	0.650H	0.563H	0.625H	0.563H	0.750H	0.600H	0.600H	0.630
1918	0.563B	0.700I	0.700I	0.700I	0.813I	0.688I	0.813I	0.650I	0.650I	0.688I	0.750I	0.750I	0.625I	0.750I	0.703
1919	0.750B	0.700J	0.775J	0.700J	0.875J	0.719J	0.900J	0.750J	0.750J	0.750J	0.875J	0.875J	0.750J	1.000J	0.798
1920	1.000B	0.925P	1.000P	0.900P	1.250P	1.000P	1.250P	1.125P	1.000P	1.000P	0.875P	1.090P	0.950P	1.000P	1.020
1921	1.000B	1.125Q	1.000Q	0.900Q	1.250Q	1 000Q	1.375Q	1.125Q	1.125Q	1.250Q	1.100Q	1.250Q	0.875Q	1.063Q	1.103
1922	0.788B	1.000B	1.000B	0.900B	1.100B	0.900B	1.100B	1.125B	0.900B	1.125B	0.935B	1.250B	0.875B	1.063B	1.004
1923	1.000B	1.000B	1 050B	0.900B	1.250B	1.100B	1.250B	1 125B	1.013B	1 250B	1.000B	1.250B	1.000B	1.063B	1.089

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.264AA	0.242AA	0.264AA	0.264AA	0.317AA	0.317AA	0.317AA	0.264AA	0.264AA	0.264AA	0.264AA	0.317AA	0.264AA	0.242AA	0.276
1891	0.272AA	0.245AA	0.272AA	0.272AA	0.320AA	0.320AA	0.320AA	0.272AA	0.272AA	0.272AA	0.272AA	0.320AA	0.272AA	0.245AA	0.282
1892	0.277AA	0.255AA	0.277AA	0.277AA	0.326AA	0.326AA	0.326AA	0.277AA	0.277AA	0.277AA	0.277AA	0.326AA	0.277AA	0.256AA	0.288
1893	0.278AA	0.258AA	0.278AA	0.278AA	0.337AA	0.337AA	0.337AA	0.278AA	0.278AA	0.278AA	0.278AA	0.337AA	0.278AA	0.258AA	0.292
1894	0.281AA	0.254AA	0.281AA	0.281AA	0.345AA	0.345AA	0.345AA	0.281AA	0.281AA	0.281AA	0.281AA	0.345AA	0.281AA	0.254AA	0.295
1895	0.278AA	0.255AA	0.278AA	0.278AA	0.341AA	0.341AA	0.341AA	0.278AA	0.278AA	0.278AA	0.278AA	0.341AA	0.278AA	0.255AA	0.293
1896	0.288AA	0.258AA	0.288AA	0.288AA	0.341AA	0.341AA	0.341AA	0.288AA	0.288AA	0.289AA	0.288AA	0.341AA	0.288AA	0.258AA	0.299
1897	0.299AA	0.257AA	0.299AA	0.299AA	0.343AA	0.343AA	0.343AA	0.299AA	0.299AA	0.299AA	0.299AA	0.343AA	0.299AA	0.257AA	0.306
1898	0.307AA	0.257AA	0.307AA	0.307AA	0.354AA	0.354AA	0.354AA	0.307AA	0.307AA	0.307AA	0.307AA	0.354AA	0.307AA	0.257AA	0.313
1899	0.309AA	0.261AA	0.309AA	0.309AA	0.365AA	0.365AA	0.365AA	0.309AA	0.309AA	0.309AA	0.309AA	0.365AA	0.309AA	0.261AA	0.318
1900	0.317AA	0.264AA	0.317AA	0.317AA	0.383AA	0.383AA	0.383AA	0.317AA	0.317AA	0.317AA	0.317AA	0.383AA	0.317AA	0.264AA	0.328
1901	0.324AA	0.279AA	0.324AA	0.324AA	0.387AA	0.387AA	0.387AA	0.324AA	0.324AA	0.324AA	0.324AA	0.387AA	0.324AA	0.279AA	0.326
1902	0.354AA	0.297AA	0.354AA	0.354AA	0.400AA	0.400AA	0.400AA	0.354AA	0.354AA	0.354AA	0.354AA	0.400AA	0.354AA	0.297AA	0.359
1903	0.366AA	0.322AA	0.366AA	0.366AA	0.426AA	0.426AA	0.426AA	0.366AA	0.366AA	0.366AA	0.366AA	0.426AA	0.366AA	0.322AA	0.377
1904	0.439CC	0.360CC	0.439CC	0.439CC	0.489CC	0.489CC	0.489CC	0.439CC	0.439CC	0.439CC	0.439CC	0.489CC	0.439CC	0.360CC	0.442
1905	0.459CC	0.379CC	0.459CC	0.459CC	0.481CC	0.481CC	0.481CC	0.459CC	0.459CC	0.459CC	0.459CC	0.481CC	0.459CC	0.379CC	0.454
1906	0.488DD	0.385DD	0.488DD	0.488DD	0.483DD	0.483DD	0.483DD	0.488DD	0.488DD	0.488DD	0.488DD	0.483DD	0.488DD	0.385DD	0.472
1907	0.500N	0.438B	0.375E	0.438B	0.650B	0.500E	0.563B	0.625E	0.438E	0.500B	0.406N	0.625E	0.406E	0.550B	0.501
1908	0.500N	0.438B	0.450E	0.438B	0.650E	0.500E	0.562B	0.625E	0.438E	0.563B	0.406N	0.663E	0.406E	0.500B	0.510
1909	0.500B	0.438B	0.450E	0.438B	0.650E	0.500E	0.562B	0.625E	0.438E	0.563B	0.438N	0.663E	0.469E	0.500B	0.517
1910	0.500B	0.375B	0.450E	0.500B	0.688E	0.563E	0.562B	0.625E	0.438E	0.563B	0.469N	0.663E	0.469E	0.500B	0.526
1911	0.600N	0.428B	0.450E	0.500N	0.688E	0.563E	0.563B	0.688E	0.500E	0.563B	0.500B	0.663E	0.469E	0.500N	0.548
1912	0.600N	0.428B	0.500E	0.500B	0.688E	0.563E	0.625B	0.688E	0.438E	0.625B	0.500B	0.663E	0.469E	0.500N	0.556
1913	0.600N	0.500K	0.500K	0.563K	0.750K	0.625K	0.625K	0.688K	0.469K	0.625B	0.500K	0.663K	0.500K	0.500K	0.579
1914	0.600B	0.500F	0.550F	0.563F	0.750F	0.618F	0.625F	0.688F	0.469F	0.625F	0.500B	0.663F	0.531F	0.563F	0.589
1915	0.438B	0.500L	0.550L	0.563L	0.750L	0.618L	0.625L	0.688L	0.469L	0.688L	0.531L	0.663L	0.531L	0.563E	0.584
1916	0.600B	0.500G	0.600G	0.563G	0.750G	0.618G	0.688G	0.688G	0.469G	0.688G	0.563G	0.663G	0.531G	0.563G	0.606
1917	0.625B	0.563H	0.650H	0.625H	0.750H	0.656H	0.750H	0.688H	0.563H	0.750H	0.594H	0.750H	0.538H	0.563H	0.648
1918	0.750B	0.688I	0.700I	0.688I	0.750I	0.656I	0.813I	0.750I	0.625I	0.750I	0.594I	0.750I	0.625I	0.750I	0.706
1919	0.800N	0.705J	0.800J	0.750J	0.844J	0.750J	0.900J	0.750J	0.800J	0.938J	0.750J	0.750J	0.750J	0.875J	0.801
1920	1.050B	0.875P	1.000P	1.000P	1.250P	1.000P	1.000P	1.125P	0.900P	1.063P	0.875P	1.000P	0.875P	1.000P	1.001
1921	1.050B	1.000B	1.000B	1.000B	1.250B	1.000B	.....	1.125B	0.875B	1.063B	1.100B	1.000B	0.875B	1.000B	1.026
1922															
1923	1.000B	1.000B	1.100B	1.000B	1.150B	1.100B	1.300B	1.250B	1.075B	1.156B	1.050B	1.500B	1.000B	0.688	1.098

NOTE.—For 1922 use rates as shown for plumbers.

Hod Carriers

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.229A	0.278A	0.257A	0.153A	0.219A	0.285A	0.167A	0.283A	0.278A			0.320A	0.173A		0.240
1891	0.231A	0.270A	0.256A	0.153A	0.219A	0.297A	0.175A	0.282A	0.271A			0.319A	0.175A		0.241
1892	0.230A	0.275A	0.259A	0.154A	0.219A	0.296A	0.195A	0.294A	0.275A			0.313A	0.173A		0.244
1893	0.227A	0.263A	0.260A	0.155A	0.219A	0.301A	0.195A	0.299A	0.276A			0.297A	0.172A		0.242
1894	0.227A	0.258A	0.261A	0.153A	0.219A	0.313A	0.195A	0.303A	0.282A			0.296A	0.179A		0.244
1895	0.227A	0.255A	0.260A	0.153A	0.213A	0.313A	0.195A	0.299A	0.274A			0.283A	0.178A		0.241
1896	0.228A	0.255A	0.260A	0.154A	0.214A	0.300A	0.195A	0.298A	0.274A			0.333A	0.179A		0.245
1897	0.228A	0.252A	0.261A	0.153A	0.250A	0.250A	0.195A	0.295A	0.268A			0.325A	0.179A		0.241
1898	0.245A	0.257A	0.261A	0.165A	0.250A	0.250A	0.195A	0.304A	0.262A			0.319A	0.179A		0.244
1899	0.242A	0.236A	0.281A	0.163A	0.250A	0.264A	0.195A	0.326A	0.271A			0.338A	0.178A		0.250
1900	0.245A	0.256A	0.288A	0.164A	0.250A	0.299A	0.220A	0.332A	0.283A			0.346A	0.179A		0.260
1901	0.243A	0.260A	0.287A	0.178A	0.250A	0.299A	0.250A	0.329A	0.279A			0.355A	0.178A		0.264
1902	0.237A	0.268A	0.291A	0.173A	0.264A	0.350A	0.250A	0.361A	0.309A			0.381A	0.187A		0.279
1903	0.237A	0.296A	0.295A	0.174A	0.325A	0.350A	0.250A	0.358A	0.349A			0.399A	0.217A		0.295
1904	0.232C	0.321C	0.304C	0.196C	0.319C	0.356C	0.247C	0.359C	0.313C	0.323C	0.239C	0.406C	0.207C	0.279C	0.293
1905	0.222C	0.323C	0.311C	0.197C	0.340C	0.355C	0.248C	0.363C	0.312C	0.311C	0.239C	0.429C	0.209C	0.281C	0.296
1906	0.255D	0.313D	0.321D	0.198D	0.357D	0.367D	0.256D	0.379D	0.308D	0.331D	0.238D	0.440D	0.217D	0.281D	0.305
1907	0.281D	0.313D	0.300E	0.201D	0.350D	0.425E	0.260D	0.375E	0.350E	0.375E	0.259D	0.453D	0.200E	0.281D	0.316
1908	0.320N	0.313E	0.300E	0.225N	0.350E	0.425E	0.250E	0.375E	0.350E	0.375E	0.250N	0.450N	0.200E	0.281N	0.319
1909	0.313B	0.313E	0.300E	0.200B	0.350E	0.425E	0.250E	0.375E	0.350E	0.375E	0.255B	0.450N	0.250E	0.313B	0.323
1910	0.320B	0.313E	0.335E	0.225B	0.425E	0.425E	0.250E	0.375E	0.350E	0.375E	0.260B	0.438B	0.250E	0.313B	0.332
1911	0.320B	0.313E	0.350E	0.250B	0.450E	0.425E	0.250E	0.375E	0.350E	0.375E	0.270B	0.450E	0.250E	0.281E	0.336
1912	0.320B	0.313E	0.350E	0.250B	0.450E	0.450E	0.281E	0.375E	0.350E	0.375E	0.270B	0.450E	0.250E	0.281E	0.340
1913	0.350B	0.313K	0.350K	0.250K	0.400K	0.425K	0.313K	0.375K	0.350K	0.375K	0.300B	0.450K	0.300K	0.281K	0.345
1914	0.300B	0.313F	0.350F	0.250B	0.400F	0.425F	0.338F	0.375F	0.350F	0.400F	0.300B	0.500F	0.325F	0.281F	0.351
1915	0.300B	0.313L	0.350L	0.250B	0.400L	0.425L	0.350L	0.375L	0.350L	0.400L	0.300L	0.500L	0.300L	0.281L	0.352
1916	0.300B	0.344G	0.413G	0.300G	0.425G	0.425G	0.350G	0.375G	0.400G	0.450F	0.300G	0.500G	0.350G	0.281G	0.372
1917	0.400B	0.400H	0.425H	0.400H	0.450H	0.500H	0.425H	0.425H	0.450H	0.500H	0.300H	0.550H	0.350H	0.313H	0.421
1918	0.400B	0.563I	0.425I	0.450I	0.500I	0.500I	0.550I	0.470I	0.600I	0.600I	0.400I	0.550I	0.500I	0.500I	0.501
1919	0.500B	0.750J	0.600J	0.550J	0.575I	0.650J	0.575J	0.538J	0.700J	0.700J	0.510J	0.638J	0.500J	0.625J	0.601
1920	0.700B	0.875P	0.700P	0.650P	1.000P	0.850P	0.875P	0.875P	1.000P	0.900P	0.550P	0.700P	0.585P	0.750P	0.786
1921	0.700B	0.875Q	0.700Q	0.550B	1.000Q	0.850Q	0.875Q	0.875Q	0.850Q	1.000Q	0.650Q	0.850Q	0.700Q	0.750Q	0.802
1922	0.500B	0.750B	0.600B	0.500B	0.725B	0.725B	0.575B	0.875B	0.700B	0.800B	0.550B	0.850B	0.600B	0.655B	0.672
1923	0.625B	0.875B	0.650B	0.550B	0.825B	0.875B	0.875B	1.000B	1.000B	1.000B	0.650B	1.000B	0.650B	1.250B	0.845

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.256AA	0.203AA	0.256AA	0.256AA	0.238AA	0.238AA	0.238AA	0.256AA	0.256AA	0.256AA	0.256AA	0.238AA	0.256AA	0.203AA	0.243
1891	0.260AA	0.203AA	0.260AA	0.260AA	0.258AA	0.258AA	0.258AA	0.260AA	0.260AA	0.260AA	0.260AA	0.258AA	0.260AA	0.203AA	0.251
1892	0.257AA	0.165AA	0.257AA	0.257AA	0.275AA	0.275AA	0.275AA	0.257AA	0.257AA	0.257AA	0.257AA	0.275AA	0.257AA	0.165AA	0.249
1893	0.257AA	0.165AA	0.257AA	0.257AA	0.280AA	0.280AA	0.280AA	0.257AA	0.257AA	0.257AA	0.257AA	0.280AA	0.257AA	0.165AA	0.251
1894	0.241AA	0.170AA	0.241AA	0.241AA	0.253AA	0.253AA	0.253AA	0.241AA	0.241AA	0.241AA	0.241AA	0.253AA	0.241AA	0.170AA	0.234
1895	0.250AA	0.186AA	0.250AA	0.250AA	0.267AA	0.267AA	0.267AA	0.250AA	0.250AA	0.250AA	0.250AA	0.267AA	0.250AA	0.186AA	0.246
1896	0.263AA	0.187AA	0.263AA	0.263AA	0.251AA	0.251AA	0.251AA	0.263AA	0.263AA	0.263AA	0.263AA	0.251AA	0.263AA	0.187AA	0.249
1897	0.266AA	0.203AA	0.266AA	0.266AA	0.290AA	0.290AA	0.290AA	0.266AA	0.266AA	0.266AA	0.266AA	0.290AA	0.266AA	0.203AA	0.264
1898	0.276AA	0.203AA	0.276AA	0.276AA	0.283AA	0.283AA	0.283AA	0.276AA	0.276AA	0.276AA	0.276AA	0.283AA	0.276AA	0.203AA	0.268
1899	0.274AA	0.212AA	0.274AA	0.274AA	0.305AA	0.305AA	0.305AA	0.274AA	0.274AA	0.274AA	0.274AA	0.305AA	0.274AA	0.212AA	0.274
1900	0.324AA	0.200AA	0.324AA	0.324AA	0.319AA	0.319AA	0.319AA	0.324AA	0.324AA	0.324AA	0.324AA	0.319AA	0.324AA	0.200AA	0.305
1901	0.407AA	0.200AA	0.407AA	0.407AA	0.335AA	0.335AA	0.335AA	0.407AA	0.407AA	0.407AA	0.407AA	0.335AA	0.407AA	0.200AA	0.357
1902	0.451AA	0.212AA	0.451AA	0.451AA	0.382AA	0.382AA	0.382AA	0.451AA	0.451AA	0.451AA	0.451AA	0.382AA	0.451AA	0.212AA	0.397
1903	0.471AA	0.265AA	0.471AA	0.471AA	0.378AA	0.378AA	0.378AA	0.471AA	0.471AA	0.471AA	0.471AA	0.378AA	0.471AA	0.265AA	0.415
1904	0.492CC	0.387CC	0.492CC	0.492CC	0.408CC	0.408CC	0.408CC	0.492CC	0.492CC	0.492CC	0.492CC	0.408CC	0.492CC	0.387CC	0.453
1905	0.517CC	0.417CC	0.517CC	0.517CC	0.396CC	0.396CC	0.396CC	0.517CC	0.517CC	0.517CC	0.517CC	0.396CC	0.517CC	0.417CC	0.468
1906	0.478DD	0.466DD	0.478DD	0.478DD	0.432DD	0.432DD	0.432DD	0.478DD	0.478DD	0.478DD	0.478DD	0.432DD	0.478DD	0.466DD	0.463
1907	0.500N	0.500E	0.450E	0.500E	0.600E	0.450E	0.600E	0.600E	0.563E	0.500E	0.500N	0.600E	0.500E	0.500E	0.526
1908	0.500N	0.500E	0.450E	0.500E	0.600E	0.450E	0.600E	0.600E	0.563E	0.563E	0.500N	0.600E	0.500E	0.500E	0.530
1909	0.500B	0.500E	0.500E	0.500E	0.625E	0.500E	0.600E	0.600E	0.563E	0.563E	0.500B	0.600E	0.500E	0.500E	0.539
1910	0.563B	0.500E	0.500E	0.500E	0.650E	0.600E	0.600E	0.625E	0.563E	0.563E	0.500B	0.600E	0.500E	0.500E	0.555
1911	0.500B	0.563E	0.563E	0.550E	0.660E	0.600E	0.650E	0.625E	0.563E	0.563E	0.500B	0.650E	0.563E	0.500E	0.575
1912	0.500B	0.563K	0.563K	0.600E	0.680E	0.600E	0.650E	0.625E	0.600E	0.563E	0.563B	0.650E	0.563E	0.563E	0.591
1913	0.500B	0.563K	0.625K	0.600K	0.680K	0.600K	0.650K	0.625K	0.600K	0.625K	0.563B	0.650K	0.563K	0.563K	0.600
1914	0.625B	0.563F	0.625F	0.625F	0.680F	0.625F	0.700F	0.625F	0.600F	0.625F	0.625L	0.650F	0.563F	0.625F	0.625
1915	0.625B	0.563L	0.625L	0.625L	0.680L	0.625L	0.700L	0.625L	0.600L	0.625L	0.625L	0.650L	0.563L	0.625L	0.625
1916	0.625B	0.625G	0.625G	0.625G	0.680G	0.625G	0.700G	0.663G	0.600G	0.625G	0.625G	0.675G	0.625G	0.625G	0.639
1917	0.625B	0.625H	0.688H	0.625H	0.690H	0.650H	0.800H	0.688H	0.700H	0.700H	0.688H	0.700H	0.625H	0.700H	0.679
1918	0.800B	0.750I	0.800I	0.700I	0.700I	0.750I	0.900I	0.800I	0.925I	0.875I	0.800I	0.800I	0.688I	0.800I	0.792
1919	0.750B	1.000J	0.800J	0.850J	0.875J	0.750J	1.000J	0.875J	0.925J	1.000J	0.900J	0.925J	0.875J	0.925J	0.889
1920	1.000B	1.250P	1.000P	1.000P	1.250P	1.000P	1.250P	1.125P	1.125P	1.000P	1.250P	1.250P	1.000P	0.980P	1.106
1921	1.000B	1.250Q	1.000Q	1.250Q	1.250Q	0.900Q	1.250Q	1.125Q	1.125Q	1.250Q	1.250Q	1.250Q	1.125Q	1.250Q	1.163
1922	1.000B	0.950B	1.000B	0.875B	1.050B	0.950B	1.100B	1.125B	0.900B	1.000B	1.063B	1.063B	0.900B	1.250B	1.016
1923	1.000B	1.250B	1.050B	1.000B	1.250B	1.100B	1.375B	1.125B	1.125B	1.250B	1.063B	1.250B	1.000B	1.250B	1.149

Iron Setters (Ornamental)

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890															
1891															
1892															
1893															
1894															
1895	Note—For years 1890–1906 use rates as shown for Iron Workers, Structural.														
1896															
1897															
1898															
1899															
1900															
1901															
1902					0.500B	0.500B	0.438B	0.563B		0.400B		0.500B		0.313B	
1903															
1904					0.525B	0.500B	0.438B	0.563B		0.450B		0.550B		0.313B	
1905															
1906															
1907		0.500B	0.400B	0.300B	0.563B	0.500B	0.600B	0.563B	0.300B	0.500B		0.550B		0.500B	0.480
1908		0.500B	0.500B	0.300B	0.563B	0.500B	0.600B	0.563B	0.300B	0.500B		0.650B	0.500B	0.500B	0.498
1909	0.500B	0.500B	0.500B	0.300B	0.600B	0.375B	0.550B	0.563B	0.563B	0.500B	0.500B	0.650B	0.500B	0.500B	0.507
1910	0.563B	0.375B	0.500B	0.400B	0.600B	0.375B	0.600B	0.625B	0.500B	0.500B	0.500B	0.600B	0.500B	0.500B	0.510
1911	0.375B	0.400B	0.563B	0.350B	0.600B	0.438B	0.650B	0.625B	0.550B	0.500B	0.500B	0.650B	0.500B	0.500B	0.514
1912	0.375B	0.400B	0.563B	0.600K	0.625K	0.500K	0.625K	0.625K	0.600K	0.594K	0.438B	0.650K	0.500B	0.500B	0.542
1913	0.375B	0.563F	0.625F	0.600K	0.675K	0.500K	0.650K	0.625K	0.600K	0.625K	0.563B	0.650K	0.500B	0.563F	0.580
1914	0.625B	0.563F	0.625F	0.625F	0.675L	0.563F	0.700F	0.625F	0.600F	0.625F	0.625L	0.650F	0.563L	0.625F	0.621
1915	0.625B	0.563L	0.625L	0.625L	0.675L	0.563L	0.700L	0.625L	0.600L	0.625L	0.625L	0.650L	0.563L	0.625L	0.621
1916	0.625B	0.625G	0.625G	0.625G	0.700G	0.563G	0.700G	0.625G	0.600G	0.625G	0.625G	0.675G	0.625G	0.625G	0.633
1917	0.700B	0.625H	0.688H	0.725H	0.700H	0.590H	0.800H	0.663H	0.700H	0.650H	0.688H	0.700H	0.625H	0.700H	0.682
1918	0.800B	0.750I	0.800I	0.700I	0.700I	0.750I	0.900I	0.688I	0.925I	0.875I	0.800I	0.800I	0.688I	0.800I	0.784
1919	0.750B	1.000J	0.800J	0.850J	0.800J	0.750J	1.000J	0.800J	0.925J	1.000J	0.900J	0.925J	0.875J	0.925J	0.879
1920	1.000B	1.250P	1.000P	1.000P	1.250P	0.925P	1.250P	1.125P	1.125P	1.000P	1.250P	1.250P	1.000P	0.980P	1.100
1921	1.000B	0.875B	1.000B	0.625B	1.250B	1.250B	1.250B	1.125B	1.250B	1.250B	1.250B	1.250B	0.750B	1.250B	1.098
1922	1.000B	0.900B	1.000B	0.675B	0.950B	0.950B	1.100B	1.125B	0.900B	1.000B	1.063B	1.063B	1.000B	1.250B	0.998
1923	1.000B	1.100B	1.050B	0.750B	1.250B	1.100B	.....	1.125B	1.100B	1.250B	1.063B	1.250B	1.000B	1.250B	1.099

LATHERS

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.352AA	0.175AA	0.352AA	0.352AA	0.211AA	0.211AA	0.211AA	0.352AA	0.352AA	0.352AA	0.352AA	0.211AA	0.352AA	0.175AA	0.287
1891	0.353AA	0.175AA	0.353AA	0.353AA	0.211AA	0.211AA	0.211AA	0.353AA	0.353AA	0.353AA	0.353AA	0.211AA	0.353AA	0.175AA	0.287
1892	0.352AA	0.188AA	0.352AA	0.352AA	0.205AA	0.205AA	0.205AA	0.352AA	0.352AA	0.352AA	0.352AA	0.205AA	0.352AA	0.188AA	0.287
1893	0.353AA	0.188AA	0.353AA	0.353AA	0.205AA	0.205AA	0.205AA	0.353AA	0.353AA	0.353AA	0.353AA	0.205AA	0.353AA	0.188AA	0.287
1894	0.353AA	0.188AA	0.353AA	0.353AA	0.207AA	0.207AA	0.207AA	0.353AA	0.353AA	0.353AA	0.353AA	0.207AA	0.353AA	0.188AA	0.288
1895	0.366AA	0.188AA	0.366AA	0.366AA	0.206AA	0.206AA	0.206AA	0.366AA	0.366AA	0.366AA	0.366AA	0.206AA	0.366AA	0.188AA	0.295
1896	0.407AA	0.188AA	0.407AA	0.407AA	0.205AA	0.205AA	0.205AA	0.407AA	0.407AA	0.407AA	0.407AA	0.205AA	0.407AA	0.188AA	0.318
1897	0.409AA	0.223AA	0.409AA	0.409AA	0.215AA	0.215AA	0.215AA	0.409AA	0.409AA	0.409AA	0.409AA	0.215AA	0.409AA	0.223AA	0.327
1898	0.406AA	0.261AA	0.406AA	0.406AA	0.224AA	0.224AA	0.224AA	0.406AA	0.406AA	0.406AA	0.406AA	0.224AA	0.406AA	0.261AA	0.333
1899	0.408AA	0.261AA	0.408AA	0.408AA	0.240AA	0.240AA	0.240AA	0.408AA	0.408AA	0.408AA	0.408AA	0.240AA	0.408AA	0.261AA	0.339
1900	0.408AA	0.313AA	0.408AA	0.408AA	0.255AA	0.255AA	0.255AA	0.408AA	0.408AA	0.408AA	0.408AA	0.255AA	0.408AA	0.313AA	0.351
1901	0.408AA	0.322AA	0.408AA	0.408AA	0.294AA	0.294AA	0.294AA	0.408AA	0.408AA	0.408AA	0.408AA	0.294AA	0.408AA	0.322AA	0.363
1902	0.408AA	0.368AA	0.408AA	0.408AA	0.325AA	0.325AA	0.325AA	0.408AA	0.407AA	0.408AA	0.408AA	0.325AA	0.408AA	0.368AA	0.378
1903	0.397AA	0.367AA	0.397AA	0.397AA	0.329AA	0.329AA	0.329AA	0.397AA	0.397AA	0.397AA	0.397AA	0.329AA	0.397AA	0.367AA	0.373
1904	0.442CC	0.313CC	0.442CC	0.442CC	0.430CC	0.430CC	0.430CC	0.442CC	0.442CC	0.442CC	0.442CC	0.430CC	0.442CC	0.313CC	0.420
1905	0.476CC	0.366CC	0.476CC	0.476CC	0.438CC	0.438CC	0.438CC	0.476CC	0.476CC	0.476CC	0.476CC	0.438CC	0.476CC	0.366CC	0.449
1906	0.445DD	0.382DD	0.445DD	0.445DD	0.443DD	0.443DD	0.443DD	0.445DD	0.445DD	0.445DD	0.445DD	0.443DD	0.445DD	0.382DD	0.435
1907	0.453DD	0.368DD	0.453DD	0.453DD	0.448DD	0.448DD	0.448DD	0.453DD	0.453DD	0.453DD	0.453DD	0.448DD	0.453DD	0.368DD	0.440
1908	0.500N	0.372*	0.477*	0.438N	0.549*	0.537*	0.447*	0.563N	0.502*	0.427*	0.425N	0.537*	0.477*	0.332*	0.470
1909	0.500B	0.375B	0.500B	0.438N	0.650B	0.625B	0.446B	0.563B	0.550B	0.400B	0.425B	0.625B	0.500B	0.297B	0.492
1910	0.500B	0.500B	0.500B	0.406B	0.688B	0.625B	0.563B	0.563B	0.500B	0.469B	0.425B	0.625B	0.500B	0.297B	0.511
1911	0.500B	0.500B	0.550B*	0.450	0.688B	0.525B	0.563B	0.625B	0.540B	0.469B	0.394B	0.625B	0.500B	0.500B*	0.531
1912	0.600B	0.500B	0.550K	0.450B	0.719K	0.563B	0.625B	0.625B	0.438B	0.625K	0.394B	0.625B	0.500B	0.500B*	0.551
1913	0.600B	0.500F	0.600K	0.500F	0.719K	0.563F	0.563F	0.625B	0.625F	0.625K	0.394B	0.688F	0.500B	0.563F	0.576
1914	0.625B	0.563F	0.600F	0.500F	0.719F	0.625F	0.625F	0.625L	0.625F	0.625F	0.469L	0.688F	0.500L	0.563F	0.597
1915	0.450B	0.563L	0.600L	0.500L	0.719L	0.625L	0.625L	0.663L	0.563L	0.625L	0.500L	0.688L	0.500L	0.563L	0.585
1916	0.500B*	0.563G	0.650G	0.500G	0.719G	0.625G	0.688G	0.688G	0.625G	0.625G	0.500G	0.688G	0.600G	0.563G	0.610
1917	0.625B	0.625H	0.725H	0.563H	0.719H	0.625H	0.750H	0.688H	0.700H	0.688H	0.550H	0.750H	0.600H	0.625H	0.660
1918	0.625B	0.750I	0.750I	0.625I	0.800I	0.688I	0.850I	0.750I	0.750I	0.688I	0.600I	0.750I	0.600I	0.750I	0.713
1919	0.850B	0.750J	0.750J	0.813J	0.800J	0.688J	0.850J	0.875J	0.750J	0.813J	0.825J	0.813J	0.600J	0.750J	0.781
1920	1.000B	1.000P	1.000P	0.875P	1.250P	1.000P	1.250P	1.125P	1.250P	0.938P	1.000P	1.250P	0.800P	0.900P	1.046
1921	1.000B	1.000B	1.000B	1.000B	1.250B	1.000B	1.250B	1.125B	1.250B	1.183B	0.900B	1.250B	1.000B	1.000B	1.086
1922	0.875B	1.000B	1.000B	1.000B	1.000B	0.950B	1.040B	1.125B	0.900B	1.125B	0.850B	1.250B	0.900B	1.125B	1.010
1923	1.000B	1.250B	1.125B	1.250B	1.125B	1.000B	1.250B	1.125B	1.375B	1.250B	1.000B	1.375B	1.000B	.....	1.171

LABORERS (BUILDING)

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.159A	0.139A	0.173A	0.147A	0.167A	.....	0.133A	.....	0.156A	.....	.....	0.169A	.....	0.208A	0.161
1891	0.159A	0.140A	0.173A	0.145A	0.167A	.....	0.150A	.....	0.157A	.....	.....	0 169A	.....	0.208A	0 163
1892	0.159A	0.139A	0.173A	0 143A	0.172A	.....	0.150A	.....	0.157A	.....	.....	0.163A	.....	0.209A	0 163
1893	0.159A	0.141A	0.173A	0 144A	0 170A	.....	0.150A	.....	0.159A	.....	.....	0 159A	.....	0.200A	0 162
1894	0 158A	0.141A	0.173A	0.145A	0.170A	.....	0.165A	.....	0.161A	.....	.....	0 142A	.....	0.200A	0 162
1895	0 158A	0.139A	0.173A	0.129A	0 170A	.....	0 161A	.....	0.158A	.....	.....	0.156A	.....	0 201A	0 161
1896	0 158A	0.140A	0.173A	0.150A	0 171A	.....	0.165A	.....	0.159A	.....	.....	0.138A	.....	0 192A	0.161
1897	0 158A	0 141A	0.175A	0 150A	0 172A	.....	0.168A	.....	0 158A	.....	.....	0 155A	.....	0 184A	0.162
1898	0 158A	0.143A	0.175A	0 165A	0 172A	.....	0 171A	.....	0.158A	.....	.....	0.142A	.....	0 184A	0 163
1899	0.156A	0.145A	0.175A	0.158A	0.170A	.....	0.169A	.....	0.159A	.....	.....	0.139A	.....	0 188A	0 162
1900	0 159A	0.150A	0.177A	0 165A	0.169A	.....	0 180A	0.219N	0.160A	0.150N	0.200N	0.140A	.....	0.174A	0.170
1901	0 159A	0.156A	0.176A	0.159A	0.192A	.....	0.188A	0.219N	0.167A	0.150N	0.200N	0 181A	.....	0 184A	0 178
1902	0 171A	0 160A	0.192A	0.166A	0.192A	.....	0 221A	0.219N	0.163A	0.150N	0.220N	0 187A	.....	0.199A	0 187
1903	0 189A	0 166A	0.191A	0 166A	0 227A	0.174N	0 225A	0 219N	0.161A	0 150N	0.220N	0.206A	.....	0.213A	0 193
1904	0.179C	0.179C	0.166C	0 177C	0.292C	0.186C	0.212C	0.188C	0.156C	0 200N	0.231C	0.200N	0.152C	0 207C	0 195
1905	0 163C	0.175C	0.175C	0.180C	0 291C	0.190C	0 213C	0.207C	0 159C	0.150N	0.231C	0.217*	0.152C	0.202C	0.193
1906	0.189D	0.180D	0.189D	0.197D	0 294D	0 202D	0 197D	0 210D	0.179D	0.179D	0 230D	0 233*	0 152D	0.209D	0 203
1907	0 197D	0.185D	0.250E	0.201D	0 350E	0.204D	0 250D	0.220D	0.180D	0.250E	0 250D	0.250E	0 155D	0 216D	0 226
1908	0 194*	0 186*	0.275E	0.200*	0.350E	0.227*	0 250E	0.219N	0.184*	0.250E	0.250N	0.250E	0.150	0.202*	0 228
1909	0 191*	0.188B	0.275E	0.200B	0.350E	0.250B	0.250E	0 350B	0.188B	0.250E	0.220B	0.250E	0.200E	0.188B	0.239
1910	0.188B	0.188B	0 300E	0.225B	0 375E	0.188B	0.250E	0.330B	0.225B	0 250E	0.260B	0.250E	0.200E	0.188B	0 244
1911	0 200B	0.185B	0 300E	0.238B	0.375E	0 188B	0 250E	0 375B	0.175B	0.250E	0 250B	0 250E	0.200E	0 231E	0 248
1912	0.250B	0.185B	0 300E	0 225K	0.375E	0.200K	0 281E	0 330B	0.250K	0.250E	0.250B	0.250E	0.250K	0 231K	0.259
1913	0 250B	0 234B	0.300K	0 225K	0.400K	0.200K	0 250B	0 330B	0.250K	0 250K	0 265B	0.250K	0.250F	0 231K	0 263
1914	0 300B	0 234B	0 350F	0 250B	0 400F	0 250F	0 313L	0 330B	0.250L	0 250F	0 265B	0 250F	0.225L	0 250F	0 280
1915	0 260B	0.201B	0.350L	0 250B	0 400L	0.250L	0 313L	0 350G	0.250L	0 250G	0 265B	0.250L	0.225L	0 250L	0 276
1916	0 275B	0 344H	0 400G	0.250B	0 425G	0 250G	0 350G	0.380G	0 250G	0.300C	0.300B	0.300G	0.300G	0 250G	0 312
1917	0 333B	0.438H	0 400H	0 400I	0.455H	0 300H	0 400H	0.365H	0.350I	0.300I	0 320I	0 375H	0 300H	0 313H	0 361
1918	0 400B	0.563I	0.450I	0.450I	0.500I	0 350I	0.550I	0.500I	0.450I	0.450I	0 400I	0.460I	0 500I	0.500I	0.466
1919	0 500B	0.750J	0.588J	0.425B	0 575J	0.400J	0.575J	0.500J	0.725J	0.500J	0.510J	0.500J	0.500J	0.500J	0.539
1920	0 700B	0 750P	0.675P	0.500B	1 000P	0.450P	0 875P	0.844P	0.750P	0.900P	0 550P	0.675P	0 585P	0.500P	0 697
1921	0.700B	0.475B	0.675B	0.500B	1 031B	0.500B	0.875B	0.813B	0.750B	0 800B	0 650B	0.675B	0 700B	0.475B	0 687
1922	0.425B	0.300B	0 550B	0.400B	0 725B	0 400B	0 575B	0.813B	0.425B	0 425B	0.500B	0.575B	0 500B	0.425B	0 503
1923	0.625B	0.375B	0.600B	0.550B	0.825B	0.500B	0.875B	0.875B	0.475B	0.700B	0.600B	0.738B	0.550B	0.500B	0.631

LABORERS (EXCAVATING)

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	.....	0.144A	0.162A	0.153A	0.150A	0.125A	0.150A	0.228A	0.150A	0.149A	0.155A	0.156A	.....	0.142A	0.155
1891	.....	0.144A	0.161A	0.156A	0.150A	0.125A	0.150A	0 232A	0.150A	0.167A	0 152A	0.156A	.....	0.136A	0.157
1892	.....	0.144A	0.161A	0.151A	0.150A	0.125A	0.150A	0 234A	0.150A	0 167A	0.151A	0.155A	.....	0.144A	0.157
1893	.....	0.144A	0.190A	0.150A	0.152A	0.150A	0.150A	0.233A	0.171A	0.167A	0.152A	0 156A	.....	0.142A	0.163
1894	.....	0.144A	0.194A	0.153A	0.158A	0.150A	0.150A	0 225A	0.170A	0 167A	0 152A	0.155A	.....	0.130A	0.162
1895	.....	0.144A	0.196A	0.150A	0.150A	0 150A	0.150A	0.233A	0.168A	0.167A	0 150A	0.166A	.....	0.140A	0.163
1896	.....	0.144A	0.193A	0.161A	0.150A	0 150A	0 150A	0 229A	0.170A	0.167A	0.150A	0 165A	.....	0.145A	0.165
1897	.....	0.144A	0.194A	0.174A	0.162A	0.150A	0.150A	0 234A	0.168A	0.167A	0 150A	0 175A	.....	0.140A	0.168
1898	.....	0.208A	0.196A	0.175A	0.161A	0.150A	0.188A	0 243A	0.206A	0.188A	0 150A	0 175A	.....	0 142A	0.182
1899	.....	0.208A	0.198A	0.156A	0.158A	0.150A	0.188A	0.250A	0.217A	0.188A	0 143A	0.175A	.....	0.142A	0.181
1900	.....	0.208A	0.193A	0.155A	0.159A	0.150A	0.188A	0.254A	0.223A	0.188A	0 188A	0 175A	.....	0.142A	0.185
1901	.....	0.208A	0.195A	0.155A	0.158A	0.178A	0.188A	0.253A	0.220A	0.188A	0 188A	0 215A	.....	0.147A	0.191
1902	.....	0.208A	0.196A	0.160A	0.157A	0.178A	0 200A	0.253A	0 215A	0.219A	0 200A	0 230A	.....	0.150A	0.197
1903	.....	0.208A	0.192A	0.161A	0.159A	0.180A	0.200A	0.254A	0.222A	0 219A	0 201A	0 225A	.....	0.161A	0.199
1904	.....	0.198C	0.200C	0.153C	0.174C	0 219C	0 204C	0.260C	0.222C	0 219C	0 213C	0 220C	0.150C	0.163C	0.200
1905	.....	0.199C	0.200C	0.155C	0.172C	0 219C	0.219C	0.254C	0.216C	0.219C	0.213C	0.230C	0.150C	0.165C	0.201
1906	.....	0.190D	0.200D	0.207D	0.262D	0.220D	0.219D	0 264D	0.216D	0.219D	0 215D	0.231D	0.173D	0.174D	0.215
1907	.....	0.191D	0.202D	0.228D	0.275D	0.220D	0.219D	0 270D	0.254D	0.232D	0.218D	0.224D	0.175D	0.183D	0.222
1908	.....	.....	0.275E	.....	.....	.....	.....	0.219E	.....	.....	.....	.....	.....	.....	0.247
1909	.....	.....	0.275E	.....	.....	.....	.....	0.219E	.....	.....	.....	.....	.....	.....	0.247
1910	.....	.....	0.300E	.....	.....	.....	.....	0.219E	.....	.....	.....	.....	.....	.....	0.260
1911	.....	.....	0.300E	.....	.....	.....	.....	0 219E	.....	.....	.....	.....	.....	.....	0.259
1912	.....	.....	0 300E	.....	0.375K	.....	.....	0.225E	.....	.....	.....	.....	.....	.....	0.275
1913	.....	.....	0.300K	.....	0.400K	.....	.....	0.225F	.....	0.250F	.....	.....	0.200K	.....	0.280
1914	.....	.....	0.350F	.....	0.400F	.....	.....	0.225F	.....	0.250F	0.280L	0.250L	0.225K	.....	0.283
1915	.....	.....	0.350	.....	0.400L	.....	.....	0.225L	.....	0.250L	0.280L	0.250L	0.225F	.....	0.286
1916	.....	.....	0.350	.....	0.425G	.....	.....	0.250G	.....	0.300G	0.280G	0.250L	0.250L	.....	0 304
1917	.....	.....	0.400H	.....	0.450	.....	.....	0.300H	.....	0.450H	0.300H	0.275I	0.275G	.....	0.350
1918	.....	.....	0.400I	.....	.....	.....	.....	0.405I	.....	.....	0.400I	0.400I	0.275H	.....	0.421
1919	.....	.....	.....	.....	.....	.....	.....	0.405J	.....	.....	.....	0.450	0.500I	.....	0.452
1920	.....	.....	0.675P	.....	.....	.....	.....	0.750P	.....	0.700P	.....	0.675P	0.500	.....	0.677
1921	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.585P	.....	0.590*
1922	0.425B	0.300B	0.550B	0.400B	0.725B	0.400B	0.575B	0.813B	0.425B	0.425B	0.500B	0.575B	0.500B	0.425B	0.503
1923	0.625B	0.375B	0.600B	0.550B	0.746Q	0.500B	0.813Q	0.567Q	0.529Q	0.525Q	0.600B	0.527Q	0.550B	0.550B	0.575

MARBLE SETTERS

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.376AA	0.478AA	0.376AA	0.376AA	0.379AA	0.379AA	0.379AA	0.376AA	0.376AA	0.376AA	0.376AA	0.379AA	0.376AA	0.478AA	0.391
1891	0.381AA	0.482AA	0.381AA	0.381AA	0.378AA	0.378AA	0.378AA	0.381AA	0.381AA	0.381AA	0.381AA	0.378AA	0.381AA	0.482AA	0.395
1892	0.431AA	0.482AA	0.431AA	0.431AA	0.408AA	0.408AA	0.408AA	0.431AA	0.431AA	0.431AA	0.431AA	0.408AA	0.431AA	0.482AA	0.432
1893	0.441AA	0.482AA	0 441AA	0.441AA	0.396AA	0.396AA	0.396AA	0.441AA	0.441AA	0.441AA	0.441AA	0.396AA	0.441AA	0.482AA	0.434
1894	0.450AA	0.482AA	0.450AA	0.450AA	0.396AA	0.396AA	0.396AA	0.450AA	0.450AA	0.450AA	0.450AA	0.396AA	0.450AA	0 482AA	0.439
1895	0.459AA	0.482AA	0.459AA	0.459AA	0.397AA	0.397AA	0.397AA	0.459AA	0.459AA	0.459AA	0.459AA	0.397AA	0.459AA	0.482AA	0.444
1896	0.451AA	0.482AA	0.451AA	0.451AA	0.396AA	0.396AA	0.396AA	0.451AA	0.451AA	0.451AA	0.451AA	0.396AA	0.451AA	0.482AA	0 439
1897	0.452AA	0.482AA	0.452AA	0.452AA	0.413AA	0.413AA	0.413AA	0.452AA	0.452AA	0.452AA	0.452AA	0.413AA	0.452AA	0.482AA	0.445
1898	0.459AA	0.485AA	0.459AA	0.459AA	0.421AA	0.421AA	0.421AA	0.459AA	0.459AA	0.459AA	0.459AA	0.421AA	0.459AA	0.485AA	0.452
1899	0.457AA	0.485AA	0.457AA	0.457AA	0.428AA	0.428AA	0.428AA	0.457AA	0.457AA	0.457AA	0.457AA	0.428AA	0.457AA	0.485AA	0.453
1900	0.471AA	0.488AA	0.471AA	0.471AA	0.446AA	0.446AA	0.446AA	0.471AA	0.471AA	0.471AA	0.471AA	0.446AA	0.471AA	0.488AA	0.466
1901	0.516AA	0.488AA	0.516AA	0.516AA	0.447AA	0.447AA	0.447AA	0.516AA	0.516AA	0.516AA	0.516AA	0.447AA	0.516AA	0.488AA	0.492
1902	0.500AA	0.507AA	0.500AA	0.500AA	0.433AA	0.433AA	0.433AA	0.500AA	0.500AA	0.500AA	0.500AA	0.433AA	0.500AA	0.507AA	0.481
1903	0.493AA	0.544AA	0.493AA	0.493AA	0.503AA	0.503AA	0.503AA	0.493AA	0.493AA	0.493AA	0.493AA	0.503AA	0.493AA	0.544AA	0.503
1904	0.531CC	0.513CC	0.531CC	0.531CC	0.513CC	0.513CC	0.513CC	0.531CC	0.531CC	0.531CC	0.531CC	0.513CC	0.531CC	0.513CC	0.523
1905	0.525CC	0.563CC	0.525CC	0.525CC	0.523CC	0.523CC	0.523CC	0.525CC	0.525CC	0.525CC	0.525CC	0.523CC	0.525CC	0.563CC	0.530
1906	0.524DD	0.538DD	0.524DD	0.524DD	0.542DD	0.542DD	0.542DD	0.524DD	0.524DD	0.524DD	0.524DD	0.542DD	0.524DD	0.538DD	0.531
1907	0.520DD	0.554DD	0.520DD	0.520DD	0.549DD	0.549DD	0.549DD	0.520DD	0.520DD	0.520DD	0.520DD	0.549DD	0.520DD	0.554DD	0.533
1908	0.409*	0.500E	0.500E	0.563B	0.500B	0.500B	0.563E	0.625E	0.500E	0.563E	0.375*	0.563E	0.450B	0.563E	0.512
1909	0.400B	0.500E	0.500E	0.563B	0.625B	0.500B	0.563E	0.625E	0.500E	0.563E	0.375B	0.563E	0.500B	0.563E	0.524
1910	0.500B	0.563E	0.500E	0.600B	0.688B	0.438B	0.625E	0.625E	0.500E	0.625E	0.550B	0.625E	0 500B	0.563E	0.564
1911	0.500B	0.625E	0.500E	0.500B	0.688B	0.438B	0.625E	0.625E	0.563E	0.625E	0.550B	0.625E	0.500B	0.625E	0.571
1912	0.500B	0.625E	0.500E	0.500B	0.688B	0.438B	0.625E	0.625E	0.600E	0.625E	0.550B	0.625E	0.500B	0.625E	0.573
1913	0.625B	0.625K	0.563K	0.625K	0.688K	0.625K	0.625K	0.688K	0.600K	0.625K	0.550B	0.625K	0.547*	0.625K	0.617
1914	0.563B	0.625F	0.563F	0 625F	0.719F	0.657F	0.625F	0.688F	0.644F	0.657F	0.550L	0 688F	0.594*	0.625F	0.630
1915	0.625B	0.688L	0.688L	0.625L	0.719L	0.688L	0.688L	0.688L	0.688L	0.688L	0.575L	0.688L	0.641*	0.625L	0.665
1916	0.688B	0.688G	0.688G	0.688G	0.719G	0.688G	0.688G	0.688G	0.688G	0.688G	0.688G	0.688G	0.688G	0.688G	0.690
1917	0.700B	0.688H	0.688H	0.688H	0.719H	0.688H	0.688H	0.688H	0.688H	0.688H	0.688H	0.688H	0.688H	0.688H	0.691
1918	0 625B	0.750I	0.750I	0.750I	0.750I	0.750I	0.750I	0.688I	0.750I	0.750I	0.719I	0.750I	0.688I	0.688I	0.726
1919	0.625B	0.750J	0.850J	0.850J	0.850J	0.850J	0.850J	0.750J	0.850J	0.850J	0.750J	0.850J	0.813J	0.750J	0.803
1920	1.000B†	1.000P	1.000P	0.900P	1.250P	1.000P	1.125P	1.125P	1.000P	0.875P	1.000P	1.000P	0.950P	0.850P	1.005
1921	.....	1.000B	1.000B	1.000B	1.250B	0.900B	.....	1.125B	1.300B	1.000B	1.000B	1.000B	1.000B	1.125B	1.058
1922	.....	1.000B	1.000B	1.000B	0.975B	.....	.....	1.125B	0.800B	1.063B	1.000B	1.000B	1.000B	1.125B	1.008
1923	.....	1.250B	1.050B	1.000B	1.250B	1.125B	1.400B	1.125B	1.125B	1.125B	1.125B	1.250B	1.500B	1.125B	1.188

NOTE.—From 1890 to 1906 rates of stone setters are shown.
From 1907 to 1922 rates of marble setters are shown.

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.299AA	0.286AA	0.299AA	0.299AA	0.259AA	0.259AA	0.259AA	0.299AA	0.299AA	0.299AA	0.299AA	0.259AA	0.299AA	0.286AA	0.286
1891	0.313AA	0.234AA	0.313AA	0.313AA	0.272AA	0.272AA	0.272AA	0.313AA	0.313AA	0.313AA	0.313AA	0.272AA	0.313AA	0.284AA	0.297
1892	0.303AA	0.286AA	0.303AA	0.303AA	0.296AA	0.295AA	0.295AA	0.303AA	0.303AA	0.303AA	0.303AA	0.295AA	0.303AA	0.286AA	0.298
1893	0.310AA	0.277AA	0.310AA	0.310AA	0.287AA	0.287AA	0.287AA	0.310AA	0.310AA	0.310AA	0.310AA	0.287AA	0.310AA	0.277AA	0.298
1894	0.310AA	0.291AA	0.311AA	0.310AA	0.272AA	0.272AA	0.272AA	0.311AA	0.311AA	0.311AA	0.311AA	0.272AA	0.311AA	0.291AA	0.297
1895	0.313AA	0.284AA	0.313AA	0.313AA	0.280AA	0.280AA	0.280AA	0.313AA	0.313AA	0.313AA	0.313AA	0.280AA	0.313AA	0.284AA	0.300
1896	0.317AA	0.300AA	0.317AA	0.317AA	0.293AA	0.293AA	0.293AA	0.317AA	0.317AA	0.317AA	0.317AA	0.293AA	0.317AA	0.300AA	0.308
1897	0.329AA	0.303AA	0.329AA	0.329AA	0.289AA	0.289AA	0.289AA	0.329AA	0.329AA	0.329AA	0.329AA	0.289AA	0.329AA	0.303AA	0.314
1898	0.321AA	0.296AA	0.321AA	0.321AA	0.298AA	0.298AA	0.298AA	0.321AA	0.321AA	0.321AA	0.321AA	0.298AA	0.321AA	0.296AA	0.311
1899	0.331AA	0.300AA	0.331AA	0.331AA	0.313AA	0.313AA	0.313AA	0.331AA	0.331AA	0.331AA	0.331AA	0.313AA	0.331AA	0.300AA	0.321
1900	0.364AA	0.298AA	0.364AA	0.364AA	0.320AA	0.320AA	0.320AA	0.364AA	0.364AA	0.364AA	0.364AA	0.320AA	0.364AA	0.298AA	0.342
1901	0.372AA	0.344AA	0.372AA	0.372AA	0.319AA	0.319AA	0.319AA	0.372AA	0.372AA	0.372AA	0.372AA	0.319AA	0.372AA	0.344AA	0.353
1902	0.391AA	0.339AA	0.391AA	0.391AA	0.364AA	0.364AA	0.364AA	0.391AA	0.391AA	0.391AA	0.391AA	0.364AA	0.391AA	0.339A	0.376
1903	0.403AA	0.393AA	0.403AA	0.403AA	0.407AA	0.407AA	0.407AA	0.403AA	0.403AA	0.403AA	0.403AA	0.407AA	0.403AA	0.393AA	0.403
1904	0.416CC	0.363CC	0.416CC	0.416CC	0.408CC	0.408CC	0.408CC	0.416CC	0.416CC	0.416CC	0.416CC	0.408CC	0.416CC	0.363CC	0.406
1905	0.431CC	0.376CC	0.431CC	0.431CC	0.412CC	0.412CC	0.412CC	0.431CC	0.431CC	0.431CC	0.431CC	0.412CC	0.431CC	0.376CC	0.418
1906	0.439DD	0.398DD	0.439DD	0.439DD	0.410DD	0.410DD	0.410DD	0.439DD	0.439DD	0.439DD	0.439DD	0.410DD	0.439DD	0.398DD	0.425
1907	0.500N	0.375E	0.406E	0.350E	0.450E	0.350E	0.375E	0.563E	0.400E	0.450E	0.375N	0.500E	0.344E	0.500E	0.424
1908	0.500N	0.375E	0.450E	0.375E	0.461E	0.350E	0.375E	0.563E	0.400E	0.450E	0.375N	0.500E	0.406E	0.500E	0.434
1909	0.500B	0.375E	0.450E	0.375E	0.461E	0.375E	0.375E	0.563E	0.400E	0.450E	0.500B	0.500E	0.406E	0.500E	0.445
1910	0.500B	0.375E	0.469E	0.400E	0.500E	0.475E	0.425E	0.563E	0.400E	0.500E	0.500B	0.563E	0.406E	0.500E	0.463
1911	0.500B	0.400E	0.500E	0.400E	0.500E	0.375E	0.425E	0.594E	0.400E	0.500E	0.406E	0.600E	0.438E	0.500E	0.467
1912	0.500B	0.400E	0.525E	0.440E	0.500E	0.375E	0.425E	0.594E	0.500E	0.500E	0.438B	0.600E	0.438E	0.500E	0.481
1913	0.500B	0.400K	0.533*	0.450K	0.650K	0.450K	0.450K	0.594K	0.500K	0.550K	0.469B	0.600K	0.438K	0.500K	0.506
1914	0.600B	0.400F	0.542*	0.500F	0.688F	0.450F	0.450F	0.625F	0.500F	0.550F	0.500B	0.600F	0.469F	0.500F	0.527
1915	0.600B	0.400L	0.550L	0.500L	0.688L	0.500L	0.500L	0.625L	0.500L	0.575L	0.500L	0.600L	0.469L	0.500L	0.536
1916	0.600B	0.400G	0.600G	0.500G	0.700G	0.500G	0.500G	0.625G	0.500G	0.600G	0.500G	0.600G	0.469G	0.500G	0.542
1917	0.600B	0.450H	0.600H	0.500H	0.700H	0.500H	0.600H	0.625H	0.563H	0.600H	0.500H	0.625H	0.500H	0.563H	0.566
1918	0.600B	0.625I	0.700I	0.563I	0.700I	0.525I	0.800I	0.700I	0.700I	0.700I	0.563I	0.650I	0.563I	0.700I	0.649
1919	0.760B	0.800J	0.800J	0.625J	0.750J	0.565J	0.850J	0.750J	0.750J	0.800J	0.760J	0.750J	0.750J	0.750J	0.747
1920	1.000B	0.800P	1.030P	0.875P	1.250P	0.700P	1.250P	1.125P	1.100P	0.900P	1.000P	0.850P	0.875P	0.925P	0.975
1921	1.000B	0.800B	1.000B	0.875B	1.250B	0.800B	1.250B	1.125B	1.075B	1.125B	1.000B	1.250B	0.875B	1.000B	1.030
1922	0.900B	0.800B	1.030B	0.813B	0.950B	0.800B	.....	1.125B	0.900B	1.000B	0.850B	1.000B	0.875B	1.000B	0.924
1923	1.000B	0.900B	1.050B	1.000B	1.150B	0.950B	1.250B	1.125B	1.000B	1.200B	1.000B	1.250B	1.000B	1.063B	1.067

NOTE.—Government statistics for cornice makers used above 1890–1906.

PAINTERS

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.278A	0.280A	0.283A	0.242A	0.305A	0.275A	0.269A	0.396A	0.293A	0.333A	0.245A	0.305A	0.187A	0.303A	0.285
1891	0.278A	0.280A	0.285A	0.242A	0.309A	0.283A	0.270A	0.394A	0.289A	0.333A	0.245A	0.305A	0.188A	0.323A	0.287
1892	0.278A	0.280A	0.287A	0.244A	0.324A	0.290A	0.270A	0.420A	0.286A	0.333A	0.253A	0.303A	0.189A	0.320A	0.291
1893	0.278A	0.280A	0.290A	0.248A	0.347A	0.300A	0.271A	0.420A	0.287A	0.333A	0.255A	0.303A	0.186A	0.350A	0.296
1894	0.278A	0.280A	0.297A	0.247A	0.327A	0.284A	0.270A	0.420A	0.282A	0.329A	0.254A	0.303A	0.186A	0.350A	0.294
1895	0.278A	0.280A	0.289A	0.248A	0.337A	0.286A	0.268A	0.417A	0.286A	0.330A	0.232A	0.303A	0.189A	0.350A	0.292
1896	0.278A	0.280A	0.294A	0.247A	0.337A	0.286A	0.271A	0.414A	0.288A	0.329A	0.255A	0.303A	0.184A	0.350A	0.294
1897	0.278A	0.280A	0.311A	0.247A	0.351A	0.264A	0.269A	0.414A	0.285A	0.327A	0.256A	0.303A	0.185A	0.350A	0.294
1898	0.278A	0.280A	0.317A	0.245A	0.351A	0.280A	0.275A	0.417A	0.283A	0.327A	0.257A	0.303A	0.202A	0.350A	0.297
1899	0.278A	0.279A	0.314A	0.269A	0.383A	0.278A	0.275A	0.417A	0.286A	0.333A	0.256A	0.323A	0.233A	0.350A	0 305
1900	0 284A	0.279A	0.317A	0.280A	0.379A	0.306A	0.280A	0.417A	0.350A	0.340A	0.257A	0.375A	0.233A	0.350A	0.318
1901	0.321A	0 279A	0.321A	0.302A	0.400A	0.331A	0.282A	0.420A	0 350A	0.351A	0.281A	0.375A	0.236A	0.350A	0.328
1902	0.318A	0 279A	0.321A	0.303A	0.400A	0.346A	0.307A	0.466A	0 350A	0.402A	0.281A	0.427A	0.277A	0.375A	0.347
1903	0.318A	0.296A	0.340A	0.360A	0.400A	0.350A	0.375A	0.482A	0.375A	0 425A	0.293A	0.449A	0.293A	0.375A	0.367
1904	0.310C	0 313C	0.350C	0.375C	0.450C	0.375C	0.375C	0.455C	0.375C	0.425C	0.301C	0.450C	0.330C	0.400C	0.378
1905	0.309C	0.375C	0.352C	0.375C	0.450C	0.375C	0.385C	0.460C	0.375C	0.425C	0.329C	0.455C	0.330C	0 435C	0.388
1906	0.332D	0.375D	0.375D	0.375D	0.481D	0.375D	0.385D	0.470D	0.375D	0.425D	0.326D	0.501D	0 340D	0.438D	0 398
1907	0 334D	0.375E	0.395E	0.375D	0.500D	0.400D	0.400D	0.500D	0.400D	0.425D	0.362D	0.500D	0.400D	0.438D	0 415
1908	0.375N	0 375E	0.410E	0.375E	0.500E	0 400E	0.400E	0.500E	0 400E	0.425E	0.375B	0.500E	0 400E	0 438E	0 420
1909	0.375B	0.375E	0 410E	0.375E	0 550E	0.425E	0.400E	0.500E	0 400E	0.425E	0 375B	0.500E	0 400E	0 438E	0 425
1910	0.400B	0 375E	0.455E	0 406E	0 600E	0 432E	0.400E	0.500E	0.425E	0 425E	0.406B	0.525E	0.400E	0 438E	0 442
1911	0 409B	0.375E	0.455E	0 438E	0 600E	0 450L	0.425E	0 500E	0.425E	0.500E	0 410B	0.550E	0 400E	0.469E	0 458
1912	0 409B	0.375E	0.500E	0 438E	0 600E	0.450E	0.450E	0.500E	0 425E	0.525E	0.469B	0.550E	0.400E	0.469E	0 469
1913	0.500B	0 375K	0 500K	0 438K	0.575K	0 500K	0.500K	0.500K	0.425K	0.550K	0.469B	0.575K	0 400K	0.500K	0 486
1914	0.500B	0 375F	0 525F	0 469F	0 700F	0.500F	0 500F	0 500F	0.425F	0 563F	0 469L	0.600F	0.400F	0.500F	0 502
1915	0.453B	0.375L	0 503L	0.469L	0 700L	0.500L	0 500L	0.500L	0.425L	0 581L	0 484L	0.625L	0.425L	0 500L	0.503
1916	0 500B	0 375H	0 605G	0.469G	0 700G	0.550G	0 550G	0.625G	0 425G	0.581G	0 500G	0 625G	0.450G	0.500G	0 532
1917	0.563B	0.438H	0 625H	0 500H	0 725H	0.550H	0 550H	0.625H	0 450H	0 650H	0 500H	0 625H	0 500H	0.563H	0.562
1918	0.625B	0 563J	0 750J	0.563J	0.750J	0.600J	0 675J	0.625J	0 600J	0 675J	0 625J	0 750J	0 500J	0.750J	0 647
1919	0.700B	0.688J	0.825J	0.625J	0 875J	0.625J	0 750J	0.750J	0 750J	0 875J	0 750J	0.750J	0 650J	0 750J	0 740
1920	0.950B	0 900P	1 000P	0.875P	1.250P	0.875P	1 125P	1.125P	1 000P	1.125P	1.000P	1.000P	0.875P	0.900P	1.000
1921	0 950B	0.900Q	1.900Q	0 875Q	1.250Q	1 000Q	1.125Q	1 125Q	1 000Q	1.125Q	1 000B	1.250Q	0 875Q	1 000Q	1.034
1922	0.763B	0 800B	1.000B	0.788B	0.950B	0.875B	1 020B	1.125B	0.800B	1.000B	0 850B	1.000B	0.875B	1.000B	0.918
1923	0.950B	0.800B	1.050B	0.813B	1.100B	1.025B	1.200B	1.250B	0.900B	1.250B	1.000B	1.125B	0 875B	1.125B	1.033

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.400N	0.328A	0.398A	0.333A	0.442A	0.366A	0.300A	0.500A	0.390A	.....	0.350N	0.500A	0.296A	.....	0.384
1891	.....	0.328A	0.399A	0.333A	0.442A	0.364A	0.300A	0.500A	0.394A	.....	0.350N	0.500A	0.295A	.....	0.382
1892	.....	0.329A	0.403A	0.333A	0.500A	0.400A	0.300A	0.500A	0.394A	.....	0.350N	0.532A	0.306A	.....	0.395
1893	.....	0.331A	0.403A	0.333A	0.500A	0.400A	0.300A	0.500A	0.442A	.....	0.350N	0.488A	0.307A	.....	0.396
1894	0.450N	0.336A	0.403A	0.333A	0.438A	0.400A	0.350A	0.500A	0.400A	.....	0.350N	0.488A	0.304A	.....	0.396
1895	0.450N	0.335A	0.404A	0.335A	0.438A	0.423A	0.389A	0.500A	0.400A	.....	0.400N	0.492A	0.306A	.....	0.406
1896	0.450N	0.345A	0.404A	0.337A	0.495A	0.450A	0.389A	0.500A	0.400A	.....	0.400N	0.413A	0.302A	.....	0.407
1897	0.450N	0.346A	0.404A	0.337A	0.500A	0.413A	0.389A	0.500A	0.400A	.....	0.400N	0.443A	0.303A	.....	0.407
1898	0.450N	0.344A	0.403A	0.348A	0.500A	0.375A	0.389A	0.500A	0.400A	.....	0.400N	0.450A	0.310A	.....	0.406
1899	0.450N	0.359A	0.453A	0.357A	0.500A	0.400A	0.389A	0.563A	0.400A	.....	0.400N	0.500A	0.318A	.....	0.424
1900	0.450N	0.394A	0.454A	0.373A	0.500A	0.422A	0.438A	0.563A	0.400A	0.438N	0.400N	0.563A	0.317A	.....	0.439
1901	0.500N	0.415A	0.454A	0.474A	0.500A	0.500A	0.438A	0.563A	0.450A	0.438N	0.450N	0.563A	0.316A	.....	0.466
1902	0.500N	0.438A	0.455A	0.500A	0.500A	0.500A	0.500A	0.625A	0.450A	0.525B	0.470N	0.625A	0.355A	0.500B	0.496
1903	0.500N	0.500A	0.472A	0.500A	0.563A	0.563A	0.500A	0.688A	0.500A	0.438N	0.500N	0.750A	0.375A	.....	0.527
1904	0.467C	0.544C	0.500C	0.500C	0.563C	0.625C	0.500C	0.680C	0.500C	0.525C	0.500N	0.750C	0.400C	0.563C	0.544
1905	0.500C	0.598C	0.502C	0.500C	0.585C	0.625C	0.563C	0.688C	0.563C	0.525C	0.530N	0.750C	0.424C	0.563C	0.565
1906	0.500D	0.625D	0.551D	0.500D	0.688D	0.625D	0.563D	0.688D	0.563D	0.563D	0.530N	0.750D	0.435D	0.625D	0.586
1907	0.600D	0.625E	0.600E	0.500E	0.688E	0.625E	0.563E	0.688E	0.594E	0.563E	0.570N	0.750E	0.450E	0.625E	0.603
1908	0.600N	0.500E	0.600E	0.500E	0.688E	0.625E	0.563E	0.688E	0.594E	0.563E	0.570N	0.750E	0.450E	0.625E	0.594
1909	0.600B	0.563E	0.650E	0.500E	0.688E	0.625E	0.563E	0.688E	0.594E	0.563E	0.570B	0.750E	0.500E	0.625E	0.605
1910	0.600B	0.563E	0.650E	0.550E	0.688E	0.625E	0.625E	0.688E	0.625E	0.625E	0.600B	0.750E	0.500E	0.625E	0.622
1911	0.600B	0.625E	0.650E	0.550E	0.688E	0.625E	0.625E	0.688E	0.625E	0.625E	0.600B	0.750E	0.500E	0.625E	0.627
1912	0.600B	0.625E	0.650E	0.550E	0.750E	0.625E	0.625E	0.688E	0.625E	0.625F	0.600B	0.750E	0.500E	0.625E	0.631
1913	0.650B	0.625K	0.650K	0.600K	0.750K	0.688K	0.625K	0.688K	0.625K	0.625K	0.650B	0.750K	0.550E	0.625K	0.650
1914	0.650B	0.625F	0.650F	0.600F	0.750F	0.750F	0.625F	0.688F	0.625F	0.688F	0.650L	0.750F	0.550K	0.625F	0.659
1915	0.650B	0.625L	0.650L	0.600L	0.750L	0.750L	0.688L	0.688L	0.625L	0.719L	0.650L	0.750L	0.600L	0.625L	0.669
1916	0.600F	0.625G	0.700G	0.600G	0.750G	0.750G	0.688G	0.750G	0.650G	0.750G	0.675G	0.750G	0.650G	0.625G	0.683
1917	0.700B	0.688H	0.700H	0.650H	0.750H	0.750H	0.750H	0.750H	0.700H	0.750H	0.700H	0.750H	0.650H	0.700H	0.713
1918	0.700B	0.720I	0.700I	0.700I	0.813I	0.750I	0.850I	0.750I	0.750I	0.750I	0.700I	0.875I	0.700I	0.700I	0.747
1919	0.875B	0.875J	0.800J	0.850J	0.875J	0.875J	0.900J	0.900J	0.800J	0.850J	0.875J	1.000J	0.800J	0.875J	0.868
1920	1.125B	1.125P	1.000P	1.000P	1.250P	1.000P	1.250P	1.188P	1.250P	1.150P	1.150P	1.250P	1.000P	1.000P	1.124
1921	1.125B	1.250Q	1.250Q	1.000Q	1.250Q	1.125Q	1.250Q	1.250Q	1.250Q	1.250Q	1.250B	1.375Q	1.500Q	1.250Q	1.241
1922	1.000B	1.250B	1.123B	1.000B	1.100B	1.125B	1.100B	1.250B	1.000B	1.125B	1.063B	1.375B	1.250B	1.250B	1.144
1923	1.125B	1.500B	1.250B	1.500B	1.250B	1.250B	1.250B	1.500B	1.375B	1.375B	1.250B	1.500B	1.375B	1.500B	1.357

PLUMBERS

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.350N	0.297A	0.426A	0.281A	0.469A	0.388A	0.284A	0.439A	0.340A	0.321A	0.278A	0.409A	.....	0.438A	0.363
1891	0.350N	0.297A	0.425A	0.304A	0.469A	0.388A	0.284A	0.438A	0.336A	0.324A	0.281A	0.438A	.....	0.438A	0.367
1892	0.350N	0.300A	0.430A	0.310A	0.469A	0.383A	0.306A	0.439A	0.339A	0.333A	0.267A	0.438A	.....	0.438A	0.369
1893	0.350N	0.300A	0.432A	0.311A	0.469A	0.388A	0.379A	0.454A	0.343A	0.359A	0.272A	0.438A	.....	0.438A	0.379
1894	0.350N	0.313A	0.428A	0.311A	0.469A	0.387A	0.389A	0.458A	0.352A	0.360A	0.270A	0.438A	.....	0.438A	0.382
1895	0.350N	0.298A	0.440A	0.308A	0.469A	0.386A	0.389A	0.459A	0.345A	0.356A	0.270A	0.438A	.....	0.438A	0.380
1896	0.350N	0.304A	0.438A	0.335A	0.469A	0.406A	0.341A	0.454A	0.347A	0.370A	0.263A	0.438A	.....	0.438A	0.381
1897	0.350N	0.297A	0.439A	0.335A	0.469A	0.406A	0.343A	0.455A	0.348A	0.368A	0.262A	0.438A	.....	0.438A	0.381
1898	0.350N	0.303A	0.433A	0.333A	0.469A	0.406A	0.343A	0.456A	0.346A	0.374A	0.273A	0.438A	.....	0.438A	0.382
1899	0.350N	0.303A	0.446A	0.331A	0.500A	0.408A	0.366A	0.457A	0.345A	0.384A	0.263A	0.457A	.....	0.438A	0.388
1900	0.400N	0.304A	0.448A	0.336A	0.500A	0.410A	0.411A	0.461A	0.354A	0.396A	0.269A	0.500A	.....	0.438A	0.402
1901	0.400N	0.295A	0.447A	0.338A	0.500A	0.431A	0.411A	0.488A	0.369A	0.408A	0.298A	0.500A	.....	0.438A	0.409
1902	0.400N	0.296A	0.450A	0.402A	0.500A	0.438A	0.438A	0.526A	0.385A	0.453A	0.319A	0.500A	.....	0.438A	0.426
1903	0.438N	0.356A	0.450A	0.438A	0.563A	0.438A	0.500A	0.526A	0.401A	0.493A	0.319A	0.625A	.....	0.500A	0.465
1904	0.438C	0.404C	0.456C	0.438C	0.563C	0.500C	0.500C	0.560C	0.438C	0.497C	0.350C	0.625C	0.404C	0.500C	0.477
1905	0.438C	0.408C	0.456C	0.438C	0.563C	0.500C	0.500C	0.592C	0.438C	0.500C	0.349C	0.625C	0.404C	0.500C	0.479
1906	0.500D	0.409D	0.476D	0.438D	0.563D	0.500D	0.563D	0.595D	0.438D	0.500D	0.404D	0.625D	0.404D	0.500D	0.494
1907	0.500D	0.438E	0.500E	0.469E	0.625E	0.500E	0.563N	0.625E	0.438E	0.500E	0.425D	0.625E	0.406E	0.500E	0.508
1908	0.500N	0.438E	0.500E	0.469E	0.650E	0.500E	0.563E	0.625E	0.438E	0.500E	0.406N	0.663E	0.406E	0.500E	0.511
1909	0.500B	0.438E	0.550E	0.469E	0.650E	0.500E	0.563E	0.625E	0.438E	0.563E	0.438B	0.663E	0.469E	0.500E	0.526
1910	0.500B	0.438E	0.550E	0.500E	0.688E	0.563E	0.563E	0.625E	0.438E	0.563E	0.469B	0.663E	0.469E	0.500E	0.538
1911	0.500B	0.500E	0.550E	0.500E	0.688E	0.563E	0.563E	0.688E	0.430B	0.563E	0.500B	0.663E	0.469E	0.500E	0.548
1912	0.500B	0.500E	0.600E	0.500E	0.688E	0.563E	0.625E	0.688E	0.438E	0.625E	0.500B	0.663E	0.469E	0.500E	0.561
1913	0.600B	0.500K	0.600K	0.563K	0.750K	0.625K	0.625K	0.688K	0.469K	0.625K	0.500B	0.663K	0.500K	0.500K	0.586
1914	0.600B	0.500F	0.650F	0.563F	0.750F	0.618F	0.625F	0.688F	0.469F	0.625F	0.500L	0.750F	0.531F	0.563F	0.602
1915	0.600N	0.500L	0.650L	0.563L	0.750L	0.618L	0.625L	0.688L	0.469L	0.688L	0.563L	0.750L	0.531L	0.563L	0.611
1916	0.600B	0.500G	0.650G	0.563G	0.750G	0.618G	0.688G	0.688G	0.469G	0.688G	0.594G	0.750G	0.531G	0.563G	0.618
1917	0.625B	0.563H	0.688H	0.625H	0.750H	0.656H	0.750H	0.688H	0.563H	0.750H	0.594H	0.750H	0.538H	0.625H	0.655
1918	0.800B	0.750I	0.750I	0.688I	0.813I	0.656I	0.900I	0.750I	0.625I	0.750I	0.594I	0.813I	0.625I	0.750I	0.733
1919	0.800B	0.750J	0.800J	0.800J	0.875J	0.750J	0.900J	0.750J	0.800J	0.938J	0.875J	1.000J	0.750J	0.875J	0.833
1920	1.050B	0.875P	1.000P	1.000P	1.250P	1.000P	1.000P	1.125P	0.900P	1.063P	0.875P	1.250P	0.875P	1.000P	1.019
1921	1.050B	1.000Q	1.000Q	1.000Q	1.250Q	1.000Q	1.375Q	1.125Q	1.150Q	1.250Q	1.100B	1.250Q	0.875Q	1.000Q	1.102
1922	1.050B	0.923B	1.000B	1.000B	0.950B	0.950B	1.100B	1.125B	0.900B	1.125B	0.935B	1.250B	0.875B	1.063B	1.018
1923	1.000B	1.000B	1.100B	1.000B	1.150B	1.100B	1.300B	1.250B	1.075B	1.156B	1.050B	1.500B	1.000B	1.250B	1.138

ROOFERS (COMPOSITION)

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.243AA	0.170AA	0.243AA	0.243AA	0.212AA	0.211AA	0.212AA	0.243AA	0.243AA	0.243AA	0.243AA	0.212AA	0.243AA	0.170AA	0.223
1891	0.246AA	0.167AA	0.246AA	0.246AA	0.232AA	0.232AA	0.232AA	0.246AA	0.246AA	0.246AA	0.246AA	0.232AA	0.246AA	0.167AA	0.231
1892	0.243AA	0.161AA	0.243AA	0.243AA	0.258AA	0.257AA	0.258AA	0.243AA	0.243AA	0.243AA	0.243AA	0.258AA	0.243AA	0.161AA	0.235
1893	0.264AA	0.164AA	0.265AA	0.265AA	0.229AA	0.229AA	0.229AA	0.245AA	0.245AA	0.245AA	0.245AA	0.229AA	0.245AA	0.164AA	0.233
1894	0.249AA	0.175AA	0.249AA	0.249AA	0.208AA	0.209AA	0.208AA	0.249AA	0.249AA	0.249AA	0.249AA	0.208AA	0.249AA	0.175AA	0.227
1895	0.251AA	0.159AA	0.251AA	0.251AA	0.203AA	0.203AA	0.203AA	0.251AA	0.251AA	0.251AA	0.251AA	0.203AA	0.251AA	0.159AA	0.224
1896	0.254AA	0.163AA	0.254AA	0.254AA	0.203AA	0.203AA	0.203AA	0.254AA	0.254AA	0.254AA	0.254AA	0.203AA	0.254AA	0.163AA	0.226
1897	0.260AA	0.167AA	0.260AA	0.260AA	0.211AA	0.211AA	0.211AA	0.260AA	0.260AA	0.260AA	0.260AA	0.211AA	0.260AA	0.167AA	0.233
1898	0.260AA	0.161AA	0.260AA	0.260AA	0.211AA	0.211AA	0.211AA	0.260AA	0.260AA	0.260AA	0.260AA	0.211AA	0.260AA	0.161AA	0.232
1899	0.258AA	0.160AA	0.258AA	0.258AA	0.228AA	0.228AA	0.228AA	0.258AA	0.258AA	0.258AA	0.258AA	0.228AA	0.258AA	0.160AA	0.235
1900	0.296AA	0.167AA	0.296AA	0.296AA	0.249AA	0.249AA	0.249AA	0.296AA	0.296AA	0.296AA	0.296AA	0.249AA	0.296AA	0.167AA	0.264
1901	0.298AA	0.159AA	0.298AA	0.298AA	0.273AA	0.273AA	0.273AA	0.298AA	0.298AA	0.298AA	0.298AA	0.273AA	0.298AA	0.159AA	0.271
1902	0.296AA	0.164AA	0.296AA	0.296AA	0.264AA	0.264AA	0.264AA	0.296AA	0.296AA	0.296AA	0.296AA	0.264AA	0.296AA	0.164AA	0.268
1903	0.287AA	0.163AA	0.287AA	0.287AA	0.276AA	0.276AA	0.276AA	0.287AA	0.287AA	0.287AA	0.287AA	0.276AA	0.287AA	0.163AA	0.266
1904	0.284CC	0.221CC	0.284CC	0.284CC	0.354CC	0.354CC	0.354CC	0.284CC	0.284CC	0.284CC	0.284CC	0.354CC	0.284CC	0.221CC	0.295
1905	0.281CC	0.225CC	0.281CC	0.281CC	0.340CC	0.340CC	0.340CC	0.281CC	0.281CC	0.281CC	0.281CC	0.340CC	0.281CC	0.225AA	0.290
1906	0.281DD	0.227DD	0.281DD	0.281DD	0.351DD	0.351DD	0.351DD	0.281DD	0.281DD	0.281DD	0.281DD	0.351DD	0.281DD	0.227DD	0.293
1907	0.291DD	0.232DD	0.291DD	0.291DD	0.354DD	0.354DD	0.354DD	0.291DD	0.291DD	0.291DD	0.291DD	0.354DD	0.291DD	0.232DD	0.300
1908	0.500N	.....	.....	.....	.....	.....	.....	0.375N	.....	.....	.....	.....	.....	.....	0.364*
1909	0.500B	.....	0.375B	0.263B	0.600B	0.375B	0.325B	0.375B	0.400B	.....	0.500B	0.525B	0.400B	0.500B	0.428
1910	0.500B	.....	0.375B	0.250B	0.600B	0.375B	0.350B	0.406B	0.375B	0.438B	0.500B	0.550B	0.450B	0.500B	0.436
1911	0 500B	0.281B	0.375B	0.400B	0.600B	0.368B	0.350B	0.406B	0.400B	0.438B	0.406B	0.600B	0.450B	0.500B	0.434
1912	0.500B	0.281B	0.406B	0.325B	0.600B	0.350B	0.350B	0.406B	0.450B	0.438B	0.438B	0.550B	0.450B	0.500B	0.432
1913	0.500B	0 400B	0.359B	0.325B	0.650B	0.425B	0.425B	0.500B	0.450B	0.500B	0.375B	0.550B	0.450B	0.500B	0.458
1914	0.600B	0.343B	0.550L	0.325B	0.650L	0.475L	0.250L	0.438L	0.450B	0.500B	0.406L	0.550L	0.450B	0.500B	0.471
1915	0.600B	0.500B	0.550L	0.375L	0.650L	0.475L	0.350L	0.438L	0.500B	0.400L	0.438L	0.600L	0.450B	0.500B	0.488
1916	0.600B	0.500B	0.550G	0.375G	0.650G	0.475G	0.450G	0.438G	0.363G	0.400G	0.438G	0.600G	0.500B	0.500B	0.489
1917	0.600B	0.500B	0.550H	0.363B	0.675H	0.500H	0.500H	0.496H	0.363H	0.450H	0.469H	0.600H	0.500B	0.328B	0.492
1918	0.625B	0 625B	0.656I	0.450B	0.675I	0.450I	0.500I	0.531I	0.525I	0.600I	0.500I	0.700J	0.530B	0.525B	0.564
1919	0 760B	0 750B	0.700B	0.575B	0.775J	0.500J	0.660J	0.594J	0.525J	0.600J	0.625J	0.700I	0.560B	0.500B	0.630
1920	1.000B	0.800B	1.000P	0.575B	1.250P	0.700P	0.660P	1.000P	0.800P	0.750P	0.900P	1.000P	0.750P	0.650B	0.845
1921	1.000B	1.000B	1.000B	0.575B	1.250B	0.700B	1.000B	1.000B	1.100B	1.000B	0.900B	1.000B	0.875B	0.650B	0.932
1922	0.900B	0.875B	1.000B	0.475B	0.925B	0.700B	.....	1.000B	0.600B	0.850B	0.800B	1.000B	0.875B	1.150B	0.858
1923	1.000B	1 125B	1 050B	0 550B	1.100B	0.850B	1.100B	1 000B	0.800B	1.000B	0.900B	1.125B	1.000B	0.625B	0.954

ROOFERS (SLATE)

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.315AA	0.259AA	0.315AA	0.315AA	0.369AA	0.369AA	0.369AA	0.315AA	0.315AA	0.315AA	0.315AA	0.369AA	0.315AA	0.259AA	0.322
1891	0.313AA	0.259AA	0.313AA	0.313AA	0.362AA	0.362AA	0.362AA	0.313AA	0.313AA	0.313AA	0.313AA	0.362AA	0.313AA	0.259AA	0.319
1892	0.313AA	0.259AA	0.313AA	0.313AA	0.364AA	0.364AA	0.364AA	0.313AA	0.313AA	0.313AA	0.313AA	0.364AA	0.313AA	0.259AA	0.320
1893	0.316AA	0.259AA	0.316AA	0.316AA	0.364AA	0.364AA	0.364AA	0.316AA	0.316AA	0.316AA	0.316AA	0.364AA	0.316AA	0.259AA	0.321
1894	0.311AA	0.259AA	0.311AA	0.311AA	0.350AA	0.350AA	0.350AA	0.311AA	0.311AA	0.311AA	0.311AA	0.350AA	0.311AA	0.259AA	0.314
1895	0.320AA	0.259AA	0.320AA	0.320AA	0.348AA	0.348AA	0.348AA	0.320AA	0.320AA	0.320AA	0.320AA	0.348AA	0.320AA	0.259AA	0.320
1896	0.320AA	0.259AA	0.320AA	0.320AA	0.349AA	0.349AA	0.319AA	0.320AA	0.320AA	0.320AA	0.320AA	0.349AA	0.320AA	0.259AA	0.319
1897	0.317AA	0.259AA	0.317AA	0.317AA	0.356AA	0.356AA	0.356AA	0.317AA	0.317AA	0.317AA	0.317AA	0.356AA	0.317AA	0.259AA	0.320
1898	0.319AA	0.265AA	0.319AA	0.319AA	0.373AA	0.373AA	0.373AA	0.319AA	0.319AA	0.319AA	0.319AA	0.373AA	0.319AA	0.265AA	0.327
1899	0.322AA	0.264AA	0.322AA	0.322AA	0.380AA	0.380AA	0.380AA	0.322AA	0.322AA	0.322AA	0.322AA	0.380AA	0.322AA	0.264AA	0.330
1900	0.358AA	0.273AA	0.358AA	0.358AA	0.393AA	0.393AA	0.393AA	0.358AA	0.358AA	0.358AA	0.358AA	0.393AA	0.358AA	0.273AA	0.356
1901	0.381AA	0.273AA	0.381AA	0.381AA	0.395AA	0.395AA	0.395AA	0.381AA	0.381AA	0.381AA	0.381AA	0.395AA	0.381AA	0.273AA	0.370
1902	0.403AA	0.307AA	0.403AA	0.403AA	0.407AA	0.407AA	0.407AA	0.403AA	0.403AA	0.403AA	0.403AA	0.406AA	0.403AA	0.307AA	0.390
1903	0.424AA	0.336AA	0.424AA	0.424AA	0.463AA	0.463AA	0.463AA	0.424AA	0.424AA	0.424AA	0.424AA	0.463AA	0.424AA	0.336AA	0.422
1904	0.375CC	0.377CC	0.375CC	0.375CC	0.429CC	0.429CC	0.429CC	0.375CC	0.375CC	0.375CC	0.375CC	0.429CC	0.375CC	0.377CC	0.391
1905	0.373CC	0.392CC	0.373CC	0.373CC	0.410CC	0.410CC	0.410CC	0.373CC	0.373CC	0.373CC	0.373CC	0.410CC	0.373CC	0.392AA	0.386
1906	0.390DD	0.405DD	0.390DD	0.390DD	0.408DD	0.408DD	0.408DD	0.390DD	0.390DD	0.390DD	0.390DD	0.408DD	0.390DD	0.405DD	0.397
1907	0.395DD	0.429DD	0.395DD	0.395DD	0.403DD	0.403DD	0.403DD	0.395DD	0.395DD	0.395DD	0.395DD	0.403DD	0.395DD	0.429DD	0.402
1908	0.500N							0.625N			0.375N				0.428
1909	0.500B	0.500B	0.438B	0.263B	0.600B	0.375B	0.325B	0.594B	0.400B	0.438*	0.406N	0.625B	0.400B	0.500B	0.455
1910	0.500B	0.500B	0.438B	0.250B	0.600B	0.375B	0.350B	0.625N	0.375B	0.438B	0.406N	0.550B	0.450B	0.500B	0.454
1911	0.500B	0.500*	0.438B	0.400B	0.600B	0.368B	0.350B	0.625N	0.400B	0.438B	0.406B	0.600B	0.450B	0.500*	0.470
1912	0.500B	0.500*	0.513B	0.500B	0.600B	0.350B	0.350B	0.625N	0.450B	0.438B	0.438B	0.550B	0.450B	0.500*	0.483
1913	0.500B	0.500*	0.550B	0.500B	0.650B	0.425B	0.550B	0 625N	0 450B	0.500B	0.375B	0.550B	0.450B	0.500B	0.509
1914	0.600B	0.500L	0.550B	0.500L	0.700L	0.500L	0.625L	0 625L	0.563L	0.600L	0.406B	0.700L	0.375L	0.563L	0.561
1915	0 600B	0.500L	0.550B	0.500L	0.700L	0.500L	0.675L	0 688L	0.563L	0 600L	0.475B	0.700L	0.406G	0.563G	0.571
1916	0 600B	0.500G	0.600B	0.550G	0 725G	0.500G	0.700G	0.688G	0.563G	0.600G	0.438B	0.700G	0.563G	0.625H	0.581
1917	0.600B	0.500H	0.550B	0.550H	0 725H	0.600H	0.800H	0.688H	0.625H	0.650H	0.531B	0.750H	0.469H	0.625H	0.619
1918	0.625B	0.600I	0.625B	0.600I	0.725I	0.600I	0.850I	0.781I	0.700I	0.750I	0.625N	0.750I	0.531I	0.625I	0.671
1919	0.750B	0.750J	0.900B	0.650J	0.800J	0.700J	1.000J	0.813J	0.800J	0.800J	0 625B	0.750J	0.563J	0.750J	0.762
1920	1.000B	0.900P	1.000B	1.000P	1.250P	0.750P	1.250P	1 125P	1.000P	1 000P	0.900B	1.000P	0.875P	1.150P	1.014
1921	1 000B	1.000B	1.000B	1.000B	1.250B	1.000B	1.250B	1.125B	1.100B	1.250B	0.900B	1.250B	0.875B	1.150B	1.082
1922	0.900B	0.875B	1.000B	1.000B	1.000B	0.950B		1.125B	0 900B	1.100B	0.800B	1.250B	0.875B	1.150B	0 994
1923	1.000B	1.125B	1.050B	1.000B	1.150B	1.100B	1 375B	1.250B	0 900B	1.250B	0.900B	1 250B	1.000B	1.150B	1.107

NOTE.—For average of 1908, take mean of average of 1907 and 1909.

Roofers (Tin)

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.291AA	0.222AA	0.291AA	0.291AA	0.259AA	0.259AA	0.259AA	0.291AA	0.291AA	0.291AA	0.291AA	0.259AA	0.291AA	0.222AA	0.272
1891	0.301AA	0.223AA	0.301AA	0.301AA	0.264AA	0.264AA	0.264AA	0.301AA	0.301AA	0.301AA	0.301AA	0.264AA	0.301AA	0.223AA	0.279
1892	0.300AA	0.223AA	0.300AA	0.300AA	0.269AA	0.269AA	0.269AA	0.300AA	0.300AA	0.300AA	0.300AA	0.269AA	0.300AA	0.223AA	0.280
1893	0.301AA	0.228AA	0.301AA	0.301AA	0.273AA	0.273AA	0.273AA	0.301AA	0.301AA	0.301AA	0.301AA	0.273AA	0.301AA	0.228AA	0.283
1894	0.290AA	0.231AA	0.290AA	0.290AA	0.267AA	0.267AA	0.267AA	0.290AA	0.290AA	0.290AA	0.290AA	0.267AA	0.290AA	0.231AA	0.275
1895	0.296AA	0.236AA	0.296AA	0.296AA	0.266AA	0.266AA	0.266AA	0.296AA	0.296AA	0.296AA	0.296AA	0.266AA	0.296AA	0.236AA	0.279
1896	0.295AA	0.234AA	0.295AA	0.295AA	0.273AA	0.273AA	0.273AA	0.295AA	0.295AA	0.295AA	0.295AA	0.273AA	0.295AA	0.234AA	0.280
1897	0.298AA	0.233AA	0.298AA	0.298AA	0.273AA	0.273AA	0.273AA	0.298AA	0.298AA	0.298AA	0.298AA	0.273AA	0.298AA	0.233AA	0.282
1898	0.301AA	0.234AA	0.301AA	0.301AA	0.277AA	0.277AA	0.277AA	0.301AA	0.301AA	0.301AA	0.301AA	0.277AA	0.301AA	0.234AA	0.284
1899	0.307AA	0.236AA	0.307AA	0.307AA	0.292AA	0.292AA	0.292AA	0.307AA	0.307AA	0.307AA	0.307AA	0.292AA	0.307AA	0.236AA	0.292
1900	0.329AA	0.240AA	0.329AA	0.329AA	0.289AA	0.289AA	0.289AA	0.329AA	0.329AA	0.329AA	0.329AA	0.289AA	0.329AA	0.240AA	0.305
1901	0.336AA	0.249AA	0.336AA	0.336AA	0.296AA	0.296AA	0.296AA	0.336AA	0.336AA	0.336AA	0.336AA	0.296AA	0.336AA	0.249AA	0.312
1902	0.357AA	0.262AA	0.357AA	0.357AA	0.315AA	0.315AA	0.315AA	0.357AA	0.357AA	0.357AA	0.357AA	0.315AA	0.357AA	0.262AA	0.332
1903	0.356AA	0.270AA	0.356AA	0.356AA	0.341AA	0.341AA	0.341AA	0.356AA	0.356AA	0.356AA	0.356AA	0.341AA	0.356AA	0.270AA	0.339
1904	0.388CC	0.314CC	0.388CC	0.388CC	0.333CC	0.333CC	0.333CC	0.388CC	0.388CC	0.388CC	0.388CC	0.333CC	0.388CC	0.314CC	0.362
1905	0.393CC	0.336CC	0.393CC	0.393CC	0.344CC	0.344CC	0.344CC	0.393CC	0.393CC	0.393CC	0.393CC	0.344CC	0.393CC	0.336CC	0.371
1906	0.438N	0.364D	0.359D	0.356D	0.397*	0.332D	0.315D	0.563D	0.374D	0.445D	0.313N	0.438D	0.340D	0.377*	0.386
1907	0.500N	0.365D	0.378D	0.360D	0.450N	0.338D	0.319D	0.563D	0.377D	0.472D	0.375N	0.470D	0.398D	0.418*	0.413
1908	0.500N	0.370*	0.407*	0.400N	0.461N	0.357*	0.322*	0.563N	0.388*	0.460*	0.375N	0.497*	0.399*	0.459*	0.426
1909	0.500B	0.375B	0.435*	0.263B	0.461N	0.375B	0.325B	0.563N	0.400B	0.449*	0.406N	0.524*	0.400B	0.500B	0.427
1910	0.500B	0.500B	0.464*	0.250B	0.500N	0.375B	0.350B	0.563B	0.375B	0.438B	0.406N	0.550B	0.450B	0.500B	0.444
1911	0.500B	0.400N	0.493*	0.400B	0.600N	0.368B	0.350B	0.594B	0.400B	0.438B	0.406B	0.600B	0.450B	0.500*	0.464
1912	0.500B	0.400*	0.521*	0.413B	0.600B	0.350B	0.350B	0.594B	0.450B	0.438B	0.438B	0.550B	0.450B	0.500*	0.468
1913	0.500B	0.400B	0.550B	0.413B	0.650B	0.425B	0.475B	0.625B	0.450B	0.500B	0.375B	0.550B	0.450B	0.500B	0.490
1914	0.600B	0.343B	0.550†	0.450N	0.650B	0.450B	.....	0.625B	0.450B	0.600B	0.406B	0.550B	0.450B	0.500B	0.510
1915	0.600B	0.500B	0.550†	0.413B	0.650B	0.475B	0.413*	0.625B	0.500B	0.600B	0.475B	0.600B	0.450B	0.500B	0.525
1916	0.600B	0.500B	0.600B	0.450N	0.650B	0.475B	0.375B	0.625N	0.450B	0.675*	0.438B	0.550B	0.500B	0.500B	0.528
1917	0.600B	0.500B	0.550B	0.500N	0.675B	0.450B	0.638*	0.625N	0.531B	0.750*	0.531B	0.600B	0.500B	0.563B	0.572
1918	0.625B	0.625B	0.725*	0.625N	0.750N	0.550B	0.763*	0.700N	0.625B	0.825*	0.625N	0.750*	0.530B	0.525B	0.660
1919	0.760B	0.750B	0.900B	0.675N	1.000B	0.625*	0.830*	0.750N	0.625B	0.900B	0.625B	0.875*	0.560B	0.750N	0.759
1920	1.000B	.....	1.000B	.....	1.250B	.....	.....	1.125N	1.100B	.....	0.900B	1.000B	.....	.....	‡
1921	1.000B	1.000B	1.000B	.....	1.250B	.....	.....	.....	1.100B	.....	0.900B	.....	0.875B	.....	1.018
1922	0.900B	0.800B	1.000B	0.813B	0.950B	0.800B	.....	1.125B	0.900B	1.000B	0.850B	1.000B	0.875B	1.000B	0.924
1923	1.000B	0.900B	1.050B	1.000B	1.150B	0.950B	1.250B	1.125B	1.000B	1.200B	1.000B	1.250B	1.000B	1.063B	1.067

STEAM FITTERS

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.322AA	0.303AA	0.322AA	0.322AA	0.306AA	0.306AA	0.306AA	0.322AA	0.322AA	0.322AA	0.322AA	0.306AA	0.322AA	0.303AA	0.315
1891	0.323AA	0.312AA	0.323AA	0.323AA	0.308AA	0.308AA	0.308AA	0.323AA	0.323AA	0.323AA	0.323AA	0.308AA	0.323AA	0.312AA	0.317
1892	0.326AA	0.332AA	0.326AA	0.326AA	0.332AA	0.332AA	0.332AA	0.326AA	0.326AA	0.326AA	0.326AA	0.332AA	0.326AA	0.302AA	0.324
1893	0.314AA	0.302AA	0.314AA	0.314AA	0.337AA	0.337AA	0.337AA	0.314AA	0.314AA	0.314AA	0.314AA	0.337AA	0.314AA	0.302AA	0.320
1894	0.326AA	0.294AA	0.326AA	0.326AA	0.338AA	0.338AA	0.338AA	0.326AA	0.326AA	0.326AA	0.326AA	0.338AA	0.326AA	0.294AA	0.324
1895	0.320AA	0.300AA	0.320AA	0.320AA	0.339AA	0.340AA	0.339AA	0.320AA	0.320AA	0.320AA	0.320AA	0.339AA	0.320AA	0.300AA	0.323
1896	0.330AA	0.309AA	0.330AA	0.330AA	0.347AA	0.347AA	0.347AA	0.330AA	0.330AA	0.330AA	0.330AA	0.347AA	0.330AA	0.309AA	0.332
1897	0.333AA	0.307AA	0.333AA	0.333AA	0.352AA	0.352AA	0.352AA	0.333AA	0.333AA	0.333AA	0.333AA	0.352AA	0.333AA	0.307AA	0.335
1898	0.337AA	0.307AA	0.337AA	0.337AA	0.369AA	0.369AA	0.369AA	0.337AA	0.337AA	0.337AA	0.337AA	0.369AA	0.337AA	0.307AA	0.342
1899	0.338AA	0.316AA	0.338AA	0.338AA	0.391AA	0.391AA	9.391AA	0.338AA	0.338AA	0.338AA	0.338AA	0.391AA	0.338AA	0.316AA	0.350
1900	0.341AA	0.315AA	0.341AA	0.341AA	0.397AA	0.397AA	0.397AA	0.341AA	0.341AA	0.340AA	0.340AA	0.397AA	0.341AA	0.315AA	0.353
1901	0.359AA	0.335AA	0.359AA	0.360AA	0.415AA	0.415AA	0.415AA	0.359AA	0.359AA	0.359AA	0.360AA	0.415AA	0.359AA	0.335AA	0.372
1902	0.376AA	0.355AA	0.376AA	0.376AA	0.428AA	0.428AA	0.428AA	0.376AA	0.376AA	0.376AA	0.376AA	0.428AA	0.376AA	0.355AA	0.387
1903	0.393AA	0.364AA	0.393AA	0.393AA	0.461AA	0.461AA	0.461AA	0.393AA	0.393AA	0.393AA	0.393AA	0.461AA	0.393AA	0.364AA	0.408
1904	0.437CC	0.407CC	0.437CC	0.437CC	0.473CC	0.473CC	0.473CC	0.437CC	0.437CC	0.437CC	0.437CC	0.473CC	0.437CC	0.407CC	0.443
1905	0.443CC	0.407CC	0.443CC	0.443CC	0.478CC	0.478CC	0.478CC	0.443CC	0.443CC	0.443CC	0.443CC	0.478CC	0.443CC	0.407CC	0.453
1906	0.475DD	0.454DD	0.475DD	0.475DD	0.496DD	0.496DD	0.496DD	0.475DD	0.475DD	0.475DD	0.475DD	0.496DD	0.475DD	0.454DD	0.478
1907	0.500N	0.438E	0.438E	0.438E	0.594E	0.475E	0.500E	0.625E	0.422E	0.500E	0.406N	0.688C	0.406E	0.500E	0.464
1908	0.500N	0.438E	0.438E	0.500E	0.594E	0.488E	0.500E	0.625E	0.438E	0.500E	0.406N	0.688C	0.406E	0.500E	0.470
1909	0.500B	0.438E	0.438E	0.500E	0.650E	0.500E	0.500E	0.625E	0.438E	0.500E	0.438B	0.688E	0.406E	0.500E	0.508
1910	0.500B	0.438E	0.500E	0.500E	0.688E	0.531E	0.563E	0.625E	0.453E	0.500E	0.479B	0.688E	0.406E	0.500E	0.527
1911	0.500B	0.500E	0.500E	0.500E	0.688E	0.531E	0.563E	0.688E	0.469E	0.500E	0.500B	0.688E	0.406E	0.500E	0.538
1912	0.500B	0.500E	0.500E	0.500E	0.720E	0.544E	0.563E	0.688E	0.469E	0.563E	0.500B	0.688E	0.406E	0.500E	0.545
1913	0.600B	0.500K	0.500K	0.563K	0.750K	0.563K	0.563K	0.688K	0.500K	0.563K	0.500B	0.750K	0.469K	0.500K	0.573
1914	0.600B	0.500F	0.500F	0.563F	0.750F	0.600F	0.625F	0.688F	0.500F	0.625F	0.500L	0.750F	0.469F	0.550F	0.588
1915	0.750B	0.500L	0.563L	0.563L	0.750L	0.625L	0.625L	0.688L	0.563L	0.625L	0.531L	0.750L	0.531L	0.575L	0.617
1916	0.600B	0.563G	0.625G	0.563G	0.750G	0.625G	0.688G	0.688G	0.500G	0.688G	0.563G	0.750G	0.531G	0.575G	0.622
1917	0.625B	0.563H	0.625H	0.625H	0.750H	0.625H	0.688H	0.688H	0.563H	0.750H	0.594H	0.750H	0.563H	0.625H	0.645
1918	0.800B	0.688I	0.688I	0.688I	0.750I	0.655I	0.813I	0.750I	0.6571	0.750I	0.594I	0.750I	0.625I	0.750I	0.712
1919	0.800B	0.875J	0.750J	0.750J	0.850J	0.810J	0.900J	0.750J	0.750J	0.900J	0.750J	0.875J	0.750J	0.750J	0.804
1920	1.050B	1.000P	1.000P	1.000P	1.250P	0.885P	1.250P	1.125P	0.875P	1.063P	0.875P	1.250P	0.875P	0.925P	1.030
1921	1.050B	1.000B	1.000B	1.000B	1.250B	1.000B	1.375B	1.125B	1.250B	1.250B	1.100B	1.250B	0.875B	1.063B	1.113
1922	1.050B	0.900B	1.000B	0.950B	0.950B	0.950B	1.100B	1.125B	0.900B	1.125B	0.935B	1.250B	1.875B	1.063B	1.012
1923	1.000B	1.000B	1.050B	1.000B	1.250B	1.100B	1.250B	1.125B	1.000B	1.250B	1.050B	1.250B	1.000B	1.125B	1.104

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890	0.323AA	0.368AA	0.323AA	0.323AA	0.420AA	0.420AA	0.420AA	0.323AA	0.323AA	0.323AA	0.323AA	0.420AA	0.323AA	0.368AA	0.357
1891	0.318AA	0.364AA	0.318AA	0.318AA	0.421AA	0.421AA	0.421AA	0.318AA	0.318AA	0.318AA	0.318AA	0.421AA	0.318AA	0.364AA	0.354
1892	0.315AA	0.359AA	0.315AA	0.315AA	0.421AA	0.421AA	0.421AA	0.315AA	0.315AA	0.315AA	0.315AA	0.421AA	0.315AA	0.359AA	0.352
1893	0.316AA	0.362AA	0.316AA	0.316AA	0.417AA	0.417AA	0.417AA	0.316AA	0.316AA	0.316AA	0.316AA	0.417AA	0.316AA	0.362AA	0.351
1894	0.313AA	0.343AA	0.313AA	0.313AA	0.382AA	0.382AA	0.382AA	0.313AA	0.313AA	0.313AA	0.313AA	0.382AA	0.313AA	0.343AA	0.337
1895	0.312AA	0.314AA	0.312AA	0.312AA	0.398AA	0.398AA	0.398AA	0.312AA	0.312AA	0.312AA	0.312AA	0.398AA	0.312AA	0.314AA	0.337
1896	0.315AA	0.382AA	0.315AA	0.315AA	0.404AA	0.404AA	0.404AA	0.315AA	0.315AA	0.315AA	0.315AA	0.404AA	0.315AA	0.382AA	0.350
1897	0.319AA	0.354AA	0.319AA	0.319AA	0.414AA	0.414AA	0.414AA	0.319AA	0.319AA	0.319AA	0.319AA	0.414AA	0.319AA	0.354AA	0.351
1898	0.333AA	0.333AA	0.333AA	0.333AA	0.395AA	0.395AA	0.395AA	0.333AA	0.333AA	0.333AA	0.333AA	0.395AA	0.333AA	0.333AA	0.351
1899	0.329AA	0.339AA	0.329AA	0.329AA	0.426AA	0.426AA	0.426AA	0.329AA	0.326AA	0.329AA	0.329AA	0.426AA	0.329AA	0.339AA	0.358
1900	0.340AA	0.352AA	0.340AA	0.340AA	0.424AA	0.424AA	0.424AA	0.340AA	0.340AA	0.340AA	0.340AA	0.424AA	0.340AA	0.352AA	0.366
1901	0.354AA	0.376AA	0.354AA	0.354AA	0.457AA	0.457AA	0.457AA	0.354AA]	0.354AA	0.354AA	0.354AA	0.457AA	0.354AA	0.376AA	0.387
1902	0.381AA	0.445AA	0.381AA	0.381AA	0.485AA	0.485AA	0.485AA	0.381AA	0.381AA	0.381AA	0.381AA	0.485AA	0.381AA	0.445AA	0.420
1903	0.407AA	0.452AA	0.407AA	0.407AA	0.519AA	0.519AA	0.519AA	0.407AA	0.407AA	0.407AA	0.407AA	0.519AA	0.407AA	0.452AA	0.445
1904	0.443CC	0.461CC	0.443CC	0.443CC	0.532CC	0.532CC	0.532CC	0.443CC	0.443CC	0.443CC	0.443CC	0.532CC	0.443CC	0.461CC	0.471
1905	0.457CC	0.456CC	0.457CC	0.457CC	0.523CC	0.523CC	0.523CC	0.457CC	0.457CC	0.457CC	0.457CC	0.523CC	0.457CC	0.456CC	0.476
1906	0.477DD	0.467DD	0.477DD	0.477DD	0.526DD	0.526DD	0.526DD	0.477DD	0.477DD	0.477DD	0.477DD	0.526DD	0.477DD	0.467DD	0.490
1907	0.600N	0.563B	0.600E	0.500E	0.628E	0.540E	0.500E	0.525E	0.500E	0.550E	0.570N	0.600E	0.395E	0.625E	0.550
1908	0.600N	0.563B	0.600E	0.500E	0.628E	0.540E	0.500E	0.550E	0.500E	0.550E	0.570N	0.600E	0.395E	0.625E	0.551
1909	0.600B	0.563B	0.600E	0.500E	0.675E	0.540E	0.500E	0.550E	0.500E	0.550E	0.570E	0.600E	0.395E	0.625E	0.555
1910	0.600B	0.563B	0.600E	0.550E	0.675E	0.540E	0.500E	0.550E	0.500E	0.550E	0.600B	0.600E	0.450E	0.625E	0.565
1911	0.600B	0.563E	0.600E	0.550E	0.675E	0.540E	0.500E	0.575E	0.500E	0.550E	0.600B	0.600E	0.450E	0.625E	0.566
1912	0.600B	0.563E	0.600E	0.550E	0.725E	0.540E	0.500E	0.575E	0.500E	0.550E	0.600E	0.600E	0.450E	0.625E	0.570
1913	0.650B	0.563K	0.650K	0.550K	0.750K	0.600K	0.500K	0.600K	0.500K	0.550K	0.650B	0.600K	0.500K	0.625K	0.592
1914	0.650B	0.563F	0.650F	0.500F	0.750F	0.600F	0.700F	0.600F	0.550F	0.550F	0.650B	0.700F	0.500F	0.667F	0.620
1915	0.650B	0.625L	0.650L	0.550L	0.750L	0.600L	0.700L	0.600L	0.550L	0.625L	0.650L	0.700L	0.500L	0.667L	0.630
1916	0.650B	0.625G	0.650G	0.550G	0.750G	0.600G	0.700G	0.625G	0.550G	0.625G	0.675G	0.700G	0.500G	0.700G	0.636
1917	0.700B	0.625H	0.700H	0.650H	0.750H	0.650H	0.750H	0.625H	0.600H	0.650H	0.700H	0.700H	0.600H	0.700H	0.671
1918	0.700B	0.625I	0.800I	0.750I	0.750I	0.700I	0.900I	0.750I	0.700I	0.650I	0.700I	0.700I	0.725I	0.750I	0.729
1919	0.875B	0.750J	0.800J	0.850J	0.875J	0.700J	0.900J	0.875J	0.800J	0.750J	0.875J	0.850J	0.750J	0.875J	0.823
1920	1.125B	1.250P	1.000P	1.000P	1.250P	0.900P	1.250P	1.250P	1.300P	0.850P	1.150P	1.000P	0.950P	1.000P	1.091
1921	1.125B	1.250B	1.000B	1.000B	1.250B	1.000B	1.250B	1.250B	1.300B	1.250B	1.250B	1.000B	1.100B	1.125B	1.154
1922	.....	1.000B	1.063B	1.000B	1.025B	1.000B	1.100B	1.125B	0.900B	1.000B	1.000B	1.000B	1.100B	1.000B	1.024
1923	.....	1.125B	1.050B	1.000B	1.250B	1.250B	1.250B	1.125B	1.125B	1.250B	1.125B	1.250B	1.100B	1.125	1.156

TILE SETTERS

Wage in dollars per hour

Year (1)	Albany (2)	Baltimore (3)	Boston (4)	Buffalo (5)	Chicago (6)	Cincinnati (7)	Cleveland (8)	New York (9)	Philadelphia (10)	Pittsburgh (11)	Rochester (12)	St. Louis (13)	Scranton (14)	Washington (15)	Average (16)
1890															
1891															
1892															
1893															
1894	NOTE.—For years 1890–1906 use rates as shown for marble setters.														
1895															
1896															
1897															
1898															
1899															
1900															
1901															
1902	.....	.....	.....	.....	0.563B	0.500B	0.438B	0.625B	.....	0.500B	.....	0.563B	.....	0.500B	
1903															
1904	.....	0.448B	.....	0.500B	0.563B	0 500B	0.438B	0.625B	0.400B	0.550B	.....	0.563B	0.500B	0.500B	
1905															
1906															
1907	.....	0.500B	0.600B	0.500B	0.625B	0.500B	0.500B	0.625B	0.550B	0.550B	.....	0.563B	.....	0.500B	0.547
1908	.....	0.500B	0.600B	0.563B	0.625B	0.500B	0.500B	0.625B	0 550B	0.550B	.....	0.563B	0.500B	0.500B	0.548
1909	0.500B	0.500B	0.600B	0.563B	0.650B	0.525B	0 469B	0.625B	0.550B	0 563B	0 500B	0.563B	0.500B	0.500B	0.553
1910	0.500B	0.500B	0.600B	0.600B	0 688B	0 625B	0.500B	0.625B	0.550B	0.600B	0.500B	0 633B	0.500B	0.500B	0.566
1911	0 500B	0.500B	0.625B	0.500B	0.688B	0.600B	0.625B	0.625B	0 575B	0.600B	0 500B	0 625B	0.500B	0.500B	0.569
1912	0.500B	0.500B	0.625B	0.500B	0 750B	0 600B	0.625B	0.625B	0.625B	0.600B	0.550B	0.625B	0.500B	0.500B	0.580
1913	0.500B	0.500K	0.688K	0.563K	0 750K	0.625K	0.594K	0.688K	0.625K	0.625K	0.550B	0 625K	0.500K	0.563K	0 600
1914	0.600B	0.500F	0.688F	0.563F	0 750F	0.625F	0.594F	0.688F	0.625F	0.625F	0.550F	0.688F	0.500F	0.563F	0 611
1915	0.625B	0.500L	0.688L	0 575L	0.750L	0.688L	0.594L	0.688L	0.625L	0.625L	0.575L	0.688L	0.500L	0.563L	0.620
1916	0 688B	0.500G	0.688G	0 600G	0.750G	0.688G	0.650G	0.688G	0 650G	0.625G	0.600G	0.688G	0.575G	0.563G	0 640
1917	0.700B	0.563H	0.750H	0 600H	0.750H	0 688H	0.650H	0.750H	0.675H	0.650H	0.600H	0.688H	0 600H	0.625H	0 664
1918	0.625B	0.650I	0.750I	0.625I	0.750I	0 688I	0.750I	0.750I	0.710I	0.675I	0.625I	0.750I	0.600I	0.626I	0 684
1919	0.625B	0.650J	0.800J	0 719J	0.750J	0.719J	0.750J	0.813J	0.800J	0.675J	0 750J	0.850J	0.719J	0.750J	0.741
1920	.....	1.000P	1.000P	1.000P	1.250P	1.000P	1.125P	1.125P	1.000P	1.000P	1 000P	1 000P	1.000P	0.850P	1.027
1921	.....	1.000B	1.000B	1 000B	1.250B	1.000B	.....	1.125B	1.050B	1.000B	1 000B	1 000B	0.850B	1.000B	1.023
1922	.....	1.000B	1.000B	0.925B	1.025B	1 000B	1.000B	1.125B	0.800B	1.000B	1.000B	1.000B	1.000B	1.000B	0.990
1923	.....	.....	1.125B	1.000B	1.300B	1.125B	.....	1.125B	1.125B	1.250B	1.125B	1.250B	1.500B	1.125B	1.186

REFERENCES FOR ALL LABOR TABLES

Note 1.

Reference to Source of Data.

A—19th Annual Report of Commissioner of Labor.

B—"Rates of wages per hour being paid in the building trades," compiled and issued by E. M. Craig, Secretary, Builders Association, 898 Chamber of Commerce Building, Chicago, Ill.
Table for years 1902–4–7–8–9–10–11–12.
Tables for years 1909–1923 inclusive.

C—Bulletin of Bureau of Labor No. 65—July, 1906.

D—Bulletin of Bureau of Labor No. 77—July, 1908.

E—Bulletin of Bureau of Labor, Statistics No. 131—Aug. 15, 1913.

F—Bulletin of Bureau of Labor, Statistics No. 171—Aug., 1915.

G—Bulletin of Bureau of Labor, Statistics No. 214—Sept., 1917.

H—Bulletin of Bureau of Labor, Statistics No. 245—Mar., 1919.

I—Bulletin of Bureau of Labor, Statistics No. 259—Oct., 1919.

J—Bulletin of Bureau of Labor, Statistics No. 274—Sept., 1920.

K—Bulletin of Bureau of Labor, Statistics No. 143—Mar. 4, 1914.

L—Bulletin of Bureau of Labor, Statistics No. 194—May, 1916.

M—Unit cost data—Buildings—New England Group.

N—Federal Valuation of the Railroads in the United States, Presidents' Conference Committee, Eastern Group Pamphlet No. 112.

P—Bulletin of Bureau of Labor Statistics No. 286—Sept., 1921.

Q—Monthly Labor Review of the U. S. Bureau of Labor—Sept., 1921.

R—Rates from the Engineering-News-Record.

Note 2.

The use of double designating letters, as *AA*, *BB*, indicates that data has been taken from average rates as recorded for state groups, as North Atlantic States, North Central States, etc. The rate for the North Atlantic Group has been used for all the 14 cities which are situated in that group. Data designated *AA* has been taken from Bulletin which has been referred to as *A*.

* Interpolated.

Note 3.

Preference is given in the following order:

1st. To Statistics of Federal Government.

2nd. To Tables of "The rates of wages per hour being paid in the building trades." Compiled and issued by E. M. Craig, Secretary, Builders Association, Chicago, Ill.

3rd. E. G. Pamphlet No. 112.

Note 4.

Rates recorded are as of June 30 of each year

Building Cost Date-Factor Data

Year	Brick, common			Brick, face			Cement			Lime		
	Cost per M. brick	Per cent of 1914 cost	Reciprocal	Cost per M. brick	Per cent of 1914 cost	Reciprocal	Cost per barrel	Per cent of 1914 cost	Reciprocal	Cost 280 lb. barrel	Per cent of 1914 cost	Reciprocal
1890	$ 7.09	100.6	0.994	$18.67	85.9	1.164	$2.18	165.2	0.606	$1 00	93.5	1.070
1891	6 24	88 5	1.130	18.68	86.0	1.163	2.18	165.2	0.606	0.94	37.9	1.138
1892	6.30	89.4	1.119	17 26	79 4	1.259	2.18	165.2	0.606	0.96	89.7	1.115
1893	6.36	90.2	1.109	17.46	80.4	1.245	2.46	186.4	0.537	0.96	89.7	1.115
1894	5 52	78.3	1 277	16 44	75 7	1.322	2.03	153 8	0 650	0.87	81.3	1.230
1895	5.83	82 7	1.209	15.23	70.1	1.427	1.69	128.0	0.781	0.81	75.7	1.321
1896	5 59	79 3	1.261	16 04	73.8	1.355	1.73	131.1	0.763	0.72	67 3	1.486
1897	5 47	77.6	1.289	16.25	74.8	1.337	1 69	128 0	0.781	0 75	70 1	1.427
1898	6.28	89.1	1.123	16.25	74.8	1.337	1.72	130.3	0.767	0.77	72.0	1.390
1899	6.21	88.1	1.135	19.68	90.6	1 104	1.77	134.1	0 746	0.82	76 6	1.305
1900	5 80	82 3	1.216	20.95	96.4	1.037	1.89	143 2	0 698	0 71	66.4	1.507
1901	6.34	89.9	1.112	20.99	96.6	1.035	1.62	122.7	0.815	0 80	74 8	1.337
1902	5.99	85.0	1 177	21 43	98 6	1 014	1.68	127.3	0 786	0.84	78.5	1.274
1903	6 53	92.6	1 080	22 69	104.4	0.958	1 76	133.3	0.750	0 82	76.6	1.305
1904	8.13	115.3	0 867	23 31	107.3	0.932	1.19	90 2	1.109	0 86	80.4	1.244
1905	8 73	123.8	0 808	22 69	104 4	0 958	1.16	87.9	1 138	0 92	86.0	1.163
1906	9.21	130 6	0 765	21.62	99 5	1.005	1.38	104 6	0.956	0 98	91.6	1.092
1907	6 89	97.7	1 023	21 24	97.8	1 023	1.46	110 6	0 904	0 99	92 5	1 081
1908	5.84	82.8	1 207	21 25	97.8	1.023	1.27	96.2	1 039	1.08	100 9	0.998
1909	7.16	101.6	0 985	22 73	104.6	0 956	1.23	93.2	1.073	1 08	100.9	0.998
1910	6.51	92 3	1 083	22 15	101.9	0 981	1.26	95 5	1 048	1 08	100.9	0 998
1911	6.70	95 0	1.052	19.94	91.8	1 090	1.20	90.9	1.100	1 15	107 5	0.930
1912	7 60	107.8	0 928	24 66	113.5	0.881	1.06	80.3	1.245	1 13	105.6	0 947
1913	7 64	108 4	0 923	24 68	113.6	0 880	1.32	100 0	1 000	1 12	104.7	0 955
1914	7.05	100 0	1 000	21 73	100 0	1 000	1.32	100 0	1 000	1.07	100 0	1.000
1915	7.05	100 0	1 000	22 32	102.7	0 974	1.19	90 2	1.109	1.28	119.6	0.836
1916	8.41	119.3	0 838	23.52	108.2	0 924	1 44	109 1	0.917	1 45	135 5	0.738
1917	9.83	139 4	0 717	23.97	110.3	0 907	1.85	140 2	0.714	1 82	170.1	0.588
1918	13 95	197 9	0.505	29.39	135.3	0 739	2.27	172 0	0 581	2 38	222.4	0.450
1919	16.23	230.2	0 434	34.63	159 4	0.628	2.73	206 8	0 484	2 76	257.9	0 388
1920	25.06	355 5	0.281	39 12	180.0	0.555	3.44	260.6	0 384	3.78	353 3	0 283
1921	20 32	288 2	0 347	41 49	190 9	0 524	2 67	202.3	0.494	3 92	366.4	0 273
1922	18 34	260.1	0.384	40 11	184.6	0.542	2.36	178.8	0.559	3.94	369.2	0.271
1923	21.27	301.7	0.331	38.97	179.3	0.558	2.50	189.4	0.528	4.01	375.8	0.266

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Stone, foundation			Stone, limestone			Stone, granite		
	Cost per cubic yard	Per cent of 1914 cost	Reciprocal	Cost per cubic foot	Per cent of 1914 cost	Reciprocal	Cost per cubic foot	Per cent of 1914 cost	Reciprocal
1890	0.91	57.6	1.736	0.68	56.7	1.765			
1891	0.91	57.6	1.736	0.68	56.7	1.765			
1892	0.91	57.6	1.736	0.68	56.7	1.765			
1893	0.96	60.8	1.646	0.68	56.7	1.765			
1894	0.96	60.8	1.646	0.68	56.7	1.765			
1895	0.95	60.1	1.663	0.68	56.7	1.765			
1896	0.96	60.8	1.646	0.73	60.8	1.644			
1897	0.97	61.4	1.629	0.73	60.8	1.644			
1898	1.04	65.8	1.519	0.73	60.8	1.644			
1899	1.04	65.8	1.519	0.73	60.8	1.644			
1900	1.07	67.7	1.477	0.88	73.3	1.364	4.45	60.4	1.656
1901	1.11	70.3	1.423	0.88	73.3	1.364	4.71	63.9	1.565
1902	1.17	74.1	1.350	0.88	73.3	1.364	5.09	69.1	1.448
1903	1.18	74.7	1.339	0.88	73.3	1.364	5.39	73.1	1.367
1904	1.19	75.3	1.328	0.88	73.3	1.364	5.67	76.9	1.300
1905	1.20	76.0	1.317	0.88	73.3	1.364	5.72	77.6	1.288
1906	1.21	76.6	1.306	1.03	85.8	1.165	5.88	79.8	1.253
1907	1.23	77.9	1.285	1.04	86.7	1.154	6.55	88.9	1.125
1908	1.24	78.5	1.274	1.04	86.7	1.154	6.57	89.2	1.122
1909	1.25	79.1	1.264	1.19	99.2	1.008	6.61	89.7	1.115
1910	1.26	79.8	1.254	1.19	99.2	1.008	6.73	91.3	1.095
1911	1.27	80.4	1.244	1.19	99.2	1.008	6.75	91.6	1.092
1912	1.29	81.7	1.225	1.19	99.2	1.008	6.79	92.1	1.085
1913	1.43	90.5	1.105	1.19	99.2	1.008	7.04	95.5	1.047
1914	1.58	100.0	1.000	1.20	100.0	1.000	7.37	100.0	1.000
1915	1.58	100.0	1.000	1.20	100.0	1.000	7.50	101.8	0.983
1916	1.78	112.7	0.888	1.30	108.3	0.923	7.58	102.9	0.972
1917	2.33	147.5	0.677	1.31	109.2	0.916	8.01	108.7	0.920
1918	3.98	251.9	0.397	1.33	110.8	0.902	8.79	119.3	0.838
1919	3.68	232.9	0.429	1.74	145.0	0.690	9.93	134.7	0.742
1920	4.30	272.2	0.367	1.86	155.0	0.645	13.10	177.8	0.563
1921	3.32	210.1	0.476	1.86	155.0	0.645	13.84	187.8	0.533
1922	3.20	202.5	0.494	1.73	144.2	0.693	12.26	166.4	0.601
1923	3.28	207.6	0.482	1.85	154.2	0.649	13.77	186.8	0.535

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Sand and gravel			Cinders			Terra cotta, fireproofing			Slate		
	Cost per cubic yard	Per cent of 1914 cost	Reciprocal	Cost per cubic yard	Per cent of 1914 cost	Reciprocal	Cost per net ton	Per cent of 1914 cost	Reciprocal	Cost per square	Per cent of 1914 cost	Reciprocal
1890	$0.69	55.2	1.812	$0.44	91.7	1.091	....	.....	.....	$5.09	88.0	1.136
1891	0 69	55.2	1 812	0 45	93 8	1 067	....	.....	.....	5.07	87 8	1.139
1892	0 69	55.2	1.812	0 43	89.6	1.116	....	.....	.....	5.16	89 2	1.121
1893	0 73	58.4	1.712	0.42	87.5	1.143	....	.....	.....	5.28	91 4	1.094
1894	0 72	57.6	1.736	0.41	85 4	1.171	....	.....	.....	4.99	86.3	1.159
1895	0.73	58.4	1.712	0.40	83 3	1.200	....	.....	.....	5 01	86.7	1.153
1896	0.73	58.4	1.712	0.40	83.3	1.200	....	.....	.....	4.85	83.9	1.192
1897	0 74	59 2	1.689	0 38	79.2	1.263	....	.....	.....	4.69	81.2	1.232
1898	0 80	64 0	1.563	0 37	77.1	1.297	....	.....	.....	5.35	92.5	1.081
1899	0.80	64.0	1.563	0.35	72.9	1.371	....	.....	.....	4.70	81.4	1.229
1900	0 82	65.6	1.524	0.41	85 4	1.171	$7.00	95.9	1.043	4.48	77.5	1.290
1901	0.85	68 0	1.471	0.43	89.6	1.116	7.15	97.9	1.021	4.65	80.4	1.244
1902	0.88	70.4	1.420	0.43	89.6	1.116	7.15	97.9	1.021	4.98	86.1	1 161
1903	0.88	70.4	1.420	0.44	91 7	1.091	7.25	99.3	1.007	5 60	96.9	1.032
1904	0 89	71.2	1.404	0.44	91.7	1.091	7.30	100.0	1.000	5.46	94.5	1 058
1905	0.89	71 2	1.404	0.43	89 6	1.116	7 05	96.6	1.035	5.27	91.2	1.096
1906	0 95	76.0	1.316	0.44	91.7	1.091	6 90	94.5	1.058	5.28	91.4	1.094
1907	0.99	79.2	1.263	0.44	91.7	1.091	7.05	96.6	1.035	5.49	94.9	1.054
1908	1 09	87 2	1.147	0.45	93 8	1.067	6.55	89.7	1.114	5 43	93 9	1.065
1909	1.09	87.2	1.147	0.46	95.8	1.044	6.90	94.5	1.058	5.35	92.5	1.081
1910	1.16	92.8	1.078	0.47	97.9	1.021	7.10	97.3	1.028	5 33	92 2	1 085
1911	1.16	92 8	1.078	0.47	97.9	1.021	7.05	96 6	1.035	5.28	91.4	1.094
1912	1.22	97.6	1.025	0 48	100 0	1.000	7.20	98 6	1.014	5 23	90.4	1.106
1913	1 24	99 2	1 008	0 48	100.0	1.000	7.80	106.8	0.936	5.59	96 7	1.034
1914	1.25	100.0	1.000	0 48	100.0	1.000	7 30	100.0	1.000	5 78	100 0	1.000
1915	1.27	101.6	0.984	0.50	104.2	0.960	7.45	102.1	0.980	5.50	95.1	1 052
1916	1.35	108.0	0.926	0.51	106.3	0.941	8.65	118.5	0 844	5 69	98.4	1 016
1917	1.56	124.8	0 801	0 55	114.6	0.873	9.35	128.1	0.781	6.73	116.5	0.858
1918	1.87	149.6	0 668	0.69	143 8	0 696	15 20	208.2	0.480	8.12	140 4	0.712
1919	2 01	160.8	0.622	0.75	156.3	0.640	14.30	195.9	0.510	8.96	155.1	0.645
1920	3.01	240.8	0.415	0.98	204.2	0.490	20.00	274.0	0.365	11.62	201.0	0.498
1921	2.62	209 6	0.477	0.98	204 2	0 490	15.40	211 0	0.474	11.39	197 1	0.507
1922	2.22	177 6	0.563	0.87	181.2	0 552	13.40	183.6	0.545	10.76	186.1	0.537
1923	2 77	221.6	0.451	0.90	187.5	0 533	13.40	183.6	0.545	10 94	189.2	0.529

Building Cost Date-Factor Data.—(*Continued*)

Year	Structural steel—erected									Wrought iron in place			Cast iron		
	Mill buildings			Roof trusses			I-beams								
	Cost per 100 lb.	Per cent of 1914 cost	Reciprocal	Cost per 100 lb.	Per cent of 1914 cost	Reciprocal	Cost per 100 lb.	Per cent of 1914 cost	Reciprocal	Cost per 100 lb.	Per cent of 1914 cost	Reciprocal	Cost per 100 lb.	Per cent of 1914 cost	Reciprocal
1890	$3.09	132.6	0.754	$4.72	125.2	0.799	$2.54	137.3	0.728	$2.99	74.8	1.338	$3.00	120.0	0.833
1891	2.80	120.2	0.832	4.44	117.8	0.849	2.26	122.2	0.818	2.87	71.8	1.394	2.80	112.0	0.893
1892	2.64	113.3	0.883	4.18	110.9	0.902	2.14	115.7	0.864	2.84	71.0	1.408	2.60	104.0	0.962
1893	2.45	105.1	0.951	3.93	104.2	0.960	1.96	105.9	0.944	2.67	66.8	1.498	2.60	104.0	0.962
1894	2.13	91.4	1.094	3.42	90.7	1.103	1.70	91.9	1.088	2.25	56.3	1.778	2.20	88.0	1.136
1895	2.40	103.0	0.971	3.89	103.2	0.969	1.92	103.8	0.963	2.39	59.8	1.674	2.20	88.0	1.136
1896	2.53	108.6	0.921	4.07	108.0	0.926	2.02	109.2	0.916	2.36	59.0	1.695	2.10	84.0	1.191
1897	2.21	94.8	1.055	3.60	95.5	1.047	1.74	94.1	1.063	2.33	58.3	1.717	1.90	76.0	1.316
1898	2.05	88.0	1.136	3.32	88.1	1.135	1.64	88.6	1.129	2.32	58.0	1.724	1.90	76.0	1.316
1899	3.06	131.3	0.762	4.94	131.0	0.763	2.44	131.9	0.758	3.13	78.3	1.278	2.50	100.0	1.000
1900	3.18	136.5	0.733	5.14	136.3	0.734	2.54	137.3	0.728	3.14	78.5	1.274	2.90	116.0	0.862
1901	2.65	113.7	0.880	4.29	113.8	0.879	2.13	115.1	0.869	3.22	80.5	1.242	2.80	112.0	0.893
1902	3.09	132.6	0.754	4.98	132.1	0.757	2.47	133.5	0.749	3.67	91.8	1.090	3.30	132.0	0.758
1903	2.77	118.9	0.841	4.46	118.3	0.845	2.21	119.5	0.837	3.61	90.3	1.108	3.50	140.0	0.714
1904	2.56	109.9	0.910	4.12	109.3	0.915	2.06	111.4	0.898	3.48	87.0	1.149	2.90	116.0	0.862
1905	2.72	116.7	0.857	4.40	116.7	0.857	2.18	117.8	0.849	3.74	93.5	1.070	3.30	132.0	0.758
1906	2.85	122.3	0.818	4.62	122.5	0.816	2.27	122.7	0.815	3.78	94.5	1.058	3.80	152.0	0.658
1907	2.86	122.7	0.815	4.62	122.5	0.816	2.28	123.2	0.812	3.97	99.3	1.008	3.90	156.0	0.641
1908	2.80	120.2	0.832	4.54	120.4	0.831	2.22	120.0	0.833	3.63	90.8	1.102	3.10	124.0	0.807
1909	2.41	103.4	0.967	3.89	103.2	0.969	1.92	103.8	0.963	3.73	93.3	1.072	3.10	124.0	0.807
1910	2.48	106.4	0.940	3.98	105.6	0.947	1.98	107.0	0.935	3.83	95.8	1.044	2.90	116.0	0.862
1911	2.29	98.3	1.017	3.70	98.1	1.019	1.82	98.4	1.016	3.64	91.0	1.099	2.60	104.0	0.962
1912	2.29	98.3	1.017	3.72	98.7	1.013	1.82	98.4	1.016	3.85	96.3	1.039	2.70	108.0	0.926
1913	2.53	108.6	0.921	4.14	109.8	0.911	1.99	107.6	0.929	4.17	104.3	0.959	2.80	112.0	0.893
1914	2.33[1]	100.0	1.000	3.77[1]	100.0	1.000	1.85[1]	100.0	1.000	4.00	100.0	1.000	2.50	100.0	1.000
1915	2.37	101.7	0.983	3.89	103.2	0.969	1.86	100.5	0.995	4.15	103.8	0.964	2.80	112.0	0.893
1916	4.01	172.1	0.581	6.40	169.8	0.589	3.22	174.1	0.574	5.73	143.3	0.698	3.80	152.0	0.658
1917	4.70	201.7	0.496	6.78	179.8	0.556	4.02	217.3	0.460	7.23	180.8	0.553	6.60	264.0	0.379
1918	4.33	185.8	0.538	6.57	174.3	0.574	3.58	193.5	0.517	7.59	189.8	0.527	7.30	292.0	0.343
1919	3.43	147.2	0.679	4.95	131.3	0.762	2.93	158.4	0.631	7.15	178.8	0.559	6.90	276.0	0.362
1920	3.80	163.1	0.613	5.27	139.8	0.715	3.31	178.9	0.559	9.03	225.8	0.443	8.90	356.0	0.281
1921	2.78	119.3	0.838	3.90	103.4	0.967	2.39	129.2	0.774	7.23	180.8	0.553	6.60	264.0	0.379
1922	2.82	121.0	0.826	4.30	114.1	0.876	2.33	125.9	0.794	6.48	162.0	0.617	5.50	220.0	0.455
1923	3.54	151.9	0.658	5.34	141.6	0.706	2.94	158.9	0.629	7.57	189.2	0.529	7.20	288.0	0.348

[1] Cost shown is average cost 1910 to 1914 inclusive. Revised December 8th, 1922.

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Lumber											
	Simple framing			Truss framing			Sheathing and boarding			Siding and weatherboarding		
	Cost	Per cent of 1914 cost	Reciprocal	Cost	Per cent of 1914 cost	Reciprocal	Cost	Per cent of 1914 cost	Reciprocal	Cost	Per cent of 1914 cost	Reciprocal
1890	$20.62	78.8	1.269	$31.12	103.3	0.968	$18.66	78.8	1.269	$26.05	73.6	1.359
1891	19.31	73.8	1.355	28.23	93.7	1.067	17.66	73.8	1.355	23.61	66.7	1.499
1892	18.19	69.5	1.439	26.54	88.1	1.135	16 63	69.5	1.439	24.07	68.0	1.471
1893	17.82	68.1	1.468	25.91	86.0	1.163	16.30	68.1	1.468	24.50	69.2	1.445
1894	17 46	66.7	1.499	24.89	82.6	1.211	15.96	66.7	1.499	24.39	68.9	1.451
1895	16.46	62.9	1.590	22.96	76.2	1.312	15.05	62.9	1.590	21.77	61.5	1.626
1896	17.22	65.8	1.520	24.89	82.6	1.211	15.75	65.8	1.520	20.85	58.9	1.698
1897	16.93	64.7	1.546	24.19	80.3	1.245	15.48	64.7	1.546	20.82	58.8	1.701
1898	16.91	64.6	1.548	24.56	81.5	1.227	15.46	64.6	1.548	20.71	58.5	1.709
1899	19.71	75.3	1.328	28.41	94.3	1.060	18.02	75.3	1.328	23.72	67.0	1.493
1900	22.38	85.5	1.170	30.97	102 8	0.973	20.46	85.5	1.170	26.83	75.8	1.319
1901	19.65	75.1	1.332	26.79	88.9	1.125	17.97	75.1	1.332	26.51	74.9	1.335
1902	20.78	79.4	1.259	28.35	94.1	1.063	19.00	79.4	1.259	28.67	81.0	1.235
1903	21.69	82.9	1.206	29.23	97.0	1.031	19.84	82.9	1.206	29.95	84.6	1.182
1904	22.01	84.1	1.189	29.74	98.7	1.013	20.13	84.1	1.189	31.01	87.6	1.142
1905	23.13	88.4	1.131	31.34	104.0	0.962	21.15	88.4	1.131	32.82	92.7	1.079
1906	29.13	111.3	0.898	40.10	133.1	0.751	26.63	111.3	0.898	37.77	106.7	0.937
1907	29.44	112.5	0.889	40.43	134 2	0.745	26.92	112.5	0.889	38.73	109.4	0.914
1908	26.59	101.6	0.984	35.52	117.9	0.848	24.31	101.6	0.984	39.68	112.1	0.892
1909	25.23	96.4	1.037	32.78	108.8	0.919	23.07	96.4	1 037	35.72	100.9	0.991
1910	25.67	98.1	1.019	33.56	111.4	0.898	23.48	98.1	1.019	35.79	101.1	0.989
1911	26.20	100.1	0.999	34.56	114.7	0.872	23.95	100.1	0.999	35.72	100.9	0.991
1912	27.16	103.8	0.963	35.64	118.3	0.845	24.84	103.8	0.963	35.61	100.6	0.994
1913	28.03	107.1	0.934	34.77	115.4	0.867	25.63	107.1	0.934	36.92	104.3	0.959
1914	26.17	100.0	1.000	30.13	100.0	1.000	23.93	100.0	1.000	35.40	100.0	1.000
1915	24.97	95.4	1.048	29.98	99.5	1.005	22.83	95.4	1.048	34.62	97.8	1.022
1916	29.47	112.6	0.888	38.17	126.7	0.789	26.95	112.6	0.888	33 88	95.7	1.045
1917	36.53	139.6	0.716	49.53	164.4	0.608	33.41	139.6	0.716	45.03	127.2	0.786
1918	44.91	171.6	0.583	63.45	210.0	0.475	41.06	171.6	0.583	53.56	151 3	0.661
1919	54.64	208.8	0.479	71.56	237.5	0.421	49.97	208.8	0.479	63.08	178.2	0.561
1920	64.64	247.0	0.405	81.23	269.6	0.371	59.11	247.0	0.405	113 95	321.9	0.311
1921	50.06	191.3	0.523	63.60	211.1	0.474	45.78	191 3	0.523	72.99	206.2	0.485
1922	50.06	191.3	0.523	69.15	229.5	0.436	45.78	191.3	0.523	83.90	237.0	0.422
1923	54.25	207.3	0.482	78.82	261.6	0.382	49.61	207.3	0.482	90 59	255 9	0.391

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Shop flooring			Flooring better class buildings			Interior sheathing T. and G.			Sheathing interior S. E. boards		
	Cost	Per cent of 1914 cost	Reciprocal	Cost	Per cent of 1914 cost	Reciprocal	Cost	Per cent of 1914 cost	Reciprocal	Cost	Per cent of 1914 cost	Reciprocal
1890	$31.43	103.3	0.968	$34.58	83.9	1.192	$26.95	83.9	1.192	$21.41	86.0	1.163
1891	28.51	93.7	1.067	33 09	80 3	1 245	25.79	80.3	1.245	19 85	79.7	1.255
1892	26.81	88.1	1.135	31.36	76 1	1.314	24 44	76.1	1.314	18 70	75.1	1.332
1893	26.17	86.0	1.163	31.03	75.3	1 328	24 19	75.3	1.328	18 28	73 4	1.362
1894	25.14	82.6	1.211	28.97	70 3	1.422	22 58	70.3	1.422	17 80	71.5	1.399
1895	23.19	76.2	1.312	25.55	62 0	1.613	19 91	62.0	1.613	16 63	66 8	1.497
1896	25.14	82.6	1.211	23.37	56.7	1.764	18 21	56.7	1.764	17 65	70.9	1.410
1897	24.44	80.3	1.245	21.96	53 3	1.876	17 12	53 3	1.876	17 28	69.4	1.441
1898	24.80	81.5	1.227	21.88	53.1	1.883	17 06	53.1	1.883	17.33	69.6	1.437
1899	28.70	94.3	1.060	31.03	75.3	1 328	24 19	75.3	1.328	20 17	81.0	1.235
1900	31.28	102.8	0.973	27.94	67.8	1.475	21.78	67.8	1.475	22 58	90.7	1.103
1901	27.05	88.9	1.125	31.48	76.4	1.309	24 54	76.4	1.309	19 72	79.2	1.263
1902	28 63	94.1	1.063	32.39	78.6	1.272	25 25	78.6	1.272	20 87	83.8	1.193
1903	29 52	97.0	1.031	32.35	78.5	1.274	25 21	78.5	1.274	21.71	87.2	1.147
1904	30.03	98.7	1.013	32.35	78.5	1 274	25.21	78.5	1.274	22.04	88.5	1.130
1905	31.65	104.0	0 962	33.63	81.6	1.225	26 21	81 6	1.225	23 16	93 6	1.075
1906	40.50	133.1	0.751	40.47	98.2	1.018	31.54	98.2	1.018	29.33	117.8	0.849
1907	40.84	134.2	0.745	41.29	100.2	0 998	32 18	100.2	0.998	29.63	119.0	0.840
1908	35.88	117.9	0.848	41.37	100.4	0 996	32 25	100.4	0.996	26.49	106.4	0.940
1909	33.11	108.8	0.919	41.05	99.6	1.004	31.99	99 6	1.004	24.92	100.1	0.999
1910	33.90	111.4	0.898	40.80	99.0	1.010	31.80	99.0	1.010	25.42	102 1	0.979
1911	34.90	114 7	0.872	39.93	96 9	1 032	31.12	96.9	1.032	26 02	104.5	0.957
1912	36 00	118.3	0.845	40.72	98.8	1 012	31.73	98.8	1.012	26 92	108.1	0.925
1913	35 12	115 4	0.867	43.52	105.6	0 947	33.92	105.6	0.947	27.29	109.6	0.912
1914	30 43	100 0	1.000	41.21	100.0	1 000	32.12	100.0	1.000	24.90	100.0	1.000
1915	30 28	99 5	1.005	38.53	93 5	1.070	30.03	93.5	1.070	24.05	96.6	1.035
1916	38 55	126 7	0.789	41 79	101.4	0 986	32.57	101.4	0.986	29.08	116.8	0.856
1917	50 03	164 4	0.608	49.62	120.4	0.831	38.67	120.4	0.831	36 63	147.1	0.680
1918	64 09	210.6	0 475	48.09	116.7	0.857	37 47	116.7	0.857	45 64	183.3	0.546
1919	72.27	237.5	0.421	70.88	172.0	0.581	55 25	172.0	0.581	54 13	217.4	0.460
1920	82.04	269.6	0.371	135 05	327.7	0.305	105.26	327.7	0.305	63 20	253.8	0.394
1921	64.24	211 1	0.474	84.81	205.8	0.486	66.10	205.8	0.486	49.10	197.2	0.507
1922	69 84	229 5	0.436	85.76	208.1	0.481	66.84	208 1	0.481	50 50	202.8	0.493
1923	79.60	261 6	0.382	99.73	242.0	0.413	77.73	242.0	0.413	55.68	223.6	0.447

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Shingles, 16 in. extra clear cedar			Windows, ordinary			Doors, ordinary			Doors, engine house			Doors, tin clad		
	Cost per M	Per cent of 1914 cost	Reciprocal	Cost per square feet	Per cent of 1914 cost	Reciprocal	Cost per square feet	Per cent of 1914 cost	Reciprocal	Cost per square feet	Per cent of 1914 cost	Reciprocal	Cost per square feet	Per cent of 1914 cost	Reciprocal
1890	....	.....	.....	0.24	82.8	1.208	0.26	83.9	1.192	0.28	63.6	1.571	0.44	73.0	1 371
1891	....	.....	.....	0.22	75.9	1.318	0.24	77.4	1.292	0.27	61.4	1.630	0.43	72.5	1.380
1892	....	.....	.....	0.22	75.9	1.318	0.24	77.4	1.292	0.27	61.4	1.630	0.43	71.8	1.393
1893	3.03	91.5	1.092	0 22	75.9	1.318	0 24	77.4	1.292	0.27	61 4	1.630	0.43	72.0	1.390
1894	2.67	80 7	1.240	0 19	65.5	1.526	0.21	67.7	1.476	0.26	59.1	1.692	0 41	68.3	1.465
1895	2.47	74 6	1.340	0 17	58.6	1.706	0.19	61 3	1.632	0 25	56.8	1.760	0 39	64.9	1.540
1896	2.49	75.2	1.329	0.16	55.2	1.813	0.18	58.1	1.722	0.25	56.8	1.760	0.38	63.8	1.568
1897	2.58	77.9	1.283	0 16	55.2	1.813	0.17	54.8	1.824	0.24	54 6	1.833	0.37	62.1	1.610
1898	2.71	81.9	1.221	0.18	62.1	1.611	0.19	61 3	1.632	0 24	54 6	1.833	0 37	60.9	1.641
1899	2.78	84.0	1.191	0.23	79.3	1.261	0.25	80 7	1.240	0.28	63 6	1.571	0.42	70.5	1.419
1900	2.88	87.0	1.149	0.27	93.1	1.074	0.30	96.8	1.033	0.31	70.5	1.419	0.47	77.8	1.286
1901	3.08	93 1	1.075	0.33	113.8	0.879	0.35	112 9	0.886	0 32	72.7	1.375	0.46	77.5	1.291
1902	3.38	102.1	0.979	0.35	120 7	0.829	0.39	125.8	0 795	0.35	79.6	1.257	0.50	83.8	1.193
1903	3.22	97.3	1.028	0.29	100.0	1.000	0 33	106 5	0 939	0 36	81 8	1.222	0 52	86.1	1.161
1904	2.98	90.0	1.111	0.29	100.0	1.000	0.32	103 2	0.969	0 36	81 8	1.222	0 52	86.0	1.163
1905	3.01	90.9	1.100	0.31	106.9	0.936	0.36	116.1	0.861	0 38	86.4	1.158	0.56	93.3	1.072
1906	3.52	106.3	0.940	0.31	106.9	0.936	0 35	112.9	0.886	0.41	93 2	1.073	0 61	101 5	0.985
1907	4.07	123.0	0.813	0 33	113.8	0 879	0.37	119.4	0.838	0.42	95.5	1.048	0.62	104.0	0.961
1908	3.70	111 8	0.895	0.31	106.9	0.936	0 36	116.1	0.861	0.42	95 5	1.048	0.61	101.8	0 982
1909	3 60	108 8	0.919	0 31	106.9	0.936	0.36	116 1	0.861	0.41	93.2	1.073	0.60	99 3	1.007
1910	3.64	110 0	0.909	0.31	106.9	0.936	0.36	116 1	0.861	0.41	93.2	1.073	0 62	102.7	0.974
1911	3.42	103 3	0.968	0.28	96.6	1.036	0.31	100 0	1.000	0.41	93.2	1.073	0.57	95 0	1.053
1912	3.58	108.2	0.925	0.27	93 1	1 074	0.30	96 8	1.033	0.42	95.5	1.048	0.58	97.5	1.026
1913	3.60	108.8	0.919	0.29	100 0	1.000	0.31	100 0	1.000	0.44	100.0	1.000	0 60	100 8	0 992
1914	3.31	100 0	1.000	0 29	100.0	1.000	0.31	100 0	1.000	0.44	100 0	1.000	0.60	100 0	1 000
1915	3.19	96 4	1 038	0.29	100 0	1.000	0 32	103 2	0.969	0.44	100.0	1.000	0 62	102.8	0.972
1916	3.57	107.9	0.927	0 32	110.3	0 906	0.36	116 1	0.861	0.49	111 4	0.898	0.74	123 7	0.808
1917	4.59	138.7	0.721	0.39	134.5	0 744	0.44	141.9	0.705	0.60	136 4	0.733	0.98	162 9	0.614
1918	4.62	139.6	0 716	0.51	175.9	0.569	0 55	177.4	0.564	0.67	152 3	0.657	1.10	183 0	0 547
1919	6.34	191.5	0.522	0.63	217.2	0 460	0.69	222 6	0.449	0.73	165.9	0 603	1.17	195 2	0.512
1920	6.50	196.4	0.509	0.89	306 9	0.326	1 03	332.3	0.301	1.08	245 5	0 407	1.62	270 3	0.370
1921	4.71	142 3	0 703	0.63	217.2	0.460	0.68	219.4	0.456	0 86	195 5	0.512	1.28	213.0	0 469
1922	5.36	161.9	0 618	0 64	220.7	0 461	0.75	241.9	0.413	0.85	193.2	0.518	1.19	199.0	0.503
1923	5.20	157.1	0.636	0.76	262.1	0.382	0.90	290.3	0.344	0.94	213.6	0.468	1.36	227.9	0.439

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Moulding, wood less than 5 in.			Moulding, wood 5 in. and over			Painting, lead and oil			Painting, calcimine			Painting, varnish		
	Cost per 100 lin. ft.	Per cent of 1914 cost	Recip-rocal	Cost per 100 lin. ft.	Per cent of 1914 cost	Recip-rocal	Cost per gallon	Per cent of 1914 cost	Recip-rocal	Cost per hundred weight	Per cent of 1914 cost	Recip-rocal	Cost per gallon	Per cent of 1914 cost	Recip-rocal
1890	$0.99	87.6	1.142	$2.45	87.6	1.142	$ 1.20	97.6	1.025	$1.78	96.2	1.039	$0.75	90.4	1.107
1891	0.90	79.7	1.255	2.23	79.7	1.255	1 13	91.9	1.089	1.65	89 2	1.121	0.67	80.7	1.239
1892	0 90	79.7	1.255	2.23	79.7	1 255	1.09	88.6	1.128	1 68	90 8	1.101	0 57	68.7	1.456
1893	0.88	78.1	1.280	2.19	78.1	1.280	1.07	87.0	1.150	1.68	90 8	1.101	0.56	67.5	1.482
1894	0.76	66.9	1.495	1 87	66.9	1.495	1.00	81.3	1.230	1.53	82.7	1.209	0.56	67 5	1.482
1895	0.66	58.1	1.721	1.63	58.1	1.721	1.01	82 1	1.218	1.41	76 2	1.412	0.56	67.5	1.482
1896	0.60	53.4	1.873	1.50	53.4	1.873	0.91	74.0	1.352	1.26	68.1	1.468	0.50	60.2	1.660
1897	0.59	51.8	1.931	1.45	51.8	1.931	0.91	74 0	1.352	1 30	70 3	1.423	0.51	61.5	1.627
1898	0.67	59.0	1 695	1.65	59.0	1.695	0 95	77.2	1.295	1 35	73.0	1.370	0.57	58.7	1.456
1899	0.93	82.3	1.215	2.30	82.3	1.215	1.01	82.1	1.218	1.44	77.8	1.285	0.78	94.0	1.064
1900	1.14	101.3	0.987	2.84	101.3	0.987	1.21	98.4	1.017	1.24	67 0	1.492	0.85	102.4	0.976
1901	1.36	120.5	0.830	3.37	120.5	0.830	1.15	93.5	1 070	1.41	76.2	1.412	0.76	84.3	1.186
1902	1.53	135.1	0.740	3.78	135.1	0.740	1.09	88.6	1.128	1.46	78.9	1.267	0.84	101.2	0.988
1903	1.24	110.1	0.908	3.08	110 1	0.908	1.09	88 6	1.128	1.42	76.8	1 303	0.95	114.5	0.874
1904	1.22	107.7	0.929	3.02	107.7	0 928	1.06	86.2	1.160	1 50	81 1	1.233	0.96	115.7	0 865
1905	1.29	113.8	0.879	3.19	113.8	0.879	1.14	92.7	1.079	1.61	87.0	1.149	1.05	126 5	0.790
1906	1.21	107.0	0.935	3 00	107.0	0.935	1.18	95.9	1.042	1.72	93.0	1.076	1.10	132.5	0.754
1907	1.32	116.7	0.857	3.27	116.7	0.857	1.20	97.6	1.025	1.72	93 0	1.076	1.05	126.5	0.790
1908	1.27	112.3	0.890	3.14	112.3	0.890	1.14	92.7	1.079	1.89	102.2	0.979	0 78	94.0	1 064
1909	1.29	114.4	0.874	3.20	114.4	0.874	1.22	99.2	1.008	1.89	102 2	0.979	0.87	104.8	0.954
1910	1.22	107.8	0.928	3.02	107.8	0.929	1.45	117.9	0.848	1.89	102 2	0.979	1.22	147.0	0.680
1911	1.17	103 3	0.968	2.89	103.3	0.968	1.50	122.0	0.820	2.00	108 1	0.925	1.23	148.2	0.675
1912	1.10	97 5	1.026	2.73	97.5	1.026	1.33	108.1	0.924	1.96	106 0	0.944	0.67	104.8	0.954
1913	1 14	101.3	0.987	2.84	101.3	0.987	1.20	97.6	1.025	1.94	104.9	0.954	0.76	91.6	1.092
1914	1.13	100 0	1.000	2.80	100.0	1.000	1.23	100.0	1.000	1.85	100.0	1.000	0.83	100.0	1.000
1915	1.11	97 9	1.021	2.74	97.9	1.021	1.29	104.9	0.954	2.24	121.1	0.826	0.82	98.8	1.012
1916	1.13	100.0	1.000	2.80	100.0	1.000	1.68	136 6	0 732	2.54	137.3	0.728	0.92	110.8	0.902
1917	1.27	112 4	0.890	3.15	112.4	0.890	2.12	172.4	0.580	3.18	171.9	0.582	1.00	120.5	0.830
1918	1.64	145.2	0.689	4.07	145.2	0.689	2.61	212 2	0.471	4.18	226.0	0.443	1.28	154.2	0.648
1919	2.24	198.1	0.505	5.55	198.1	0.505	2.82	229 3	0.436	4.83	261.1	0.383	2 25	271.1	0.369
1920	3 60	318.4	0.314	8.92	318.4	0.314	3.02	245.5	0.407	6.63	358.4	0.279	3.05	367.5	0 272
1921	2.30	203.9	0.490	5 71	203.9	0.490	2.20	178 9	0.559	5.88	371 9	0.269	1.20	144.6	0.692
1922	2.70	238.8	0.418	6.69	238.8	0.418	2.19	177 9	0.562	6.97	376.8	0.265	1.91	230.1	0.434
1923	3.23	285.5	0.350	7.99	285.5	0.350	2.26	183.3	0.546	7.07	382.7	0.262	2.50	301.2	0.332

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Doors, steel rolling			Skylights, copper			Skylights, galvanized iron			Exterior and roofing corrugated galvanized steel 20 gauge			Exterior and roofing corrugated galvanized steel 22 gauge		
	Cost per square foot	Per cent of 1914 cost	Reciprocal	Cost per square foot	Per cent of 1914 cost	Reciprocal	Cost per square foot	Per cent of 1914 cost	Reciprocal	Cost per 100 sq. ft.	Per cent of 1914 cost	Reciprocal	Cost per 100 sq. ft.	Per cent of 1914 cost	Reciprocal
1890	$0.64	119.1	0.839	$0.71	154.5	0.647	$0.56	173.7	0.576	$10 29	140.4	0.712	$ 9.10	140.4	0.712
1891	0 61	113.1	0.884	0.66	144.8	0 690	0.55	170 3	0.587	9.59	130.8	0.765	8.49	131.0	0.763
1892	0 60	110.3	0.907	0.55	121 0	0.826	0.46	145.0	0.690	9.33	127.3	0 786	8 24	127.2	0.786
1893	0.58	107.7	0.929	0.54	118.8	0.842	0.46	144.4	0 693	9 05	123.5	0.810	8 00	123 5	0.810
1894	0 52	96.6	1.034	0 46	101.3	0 987	0 38	118.8	0 842	7.96	108.6	0.921	7 03	108.5	0.922
1895	0.54	99 7	1.003	0.44	96.3	1 039	0.36	112.2	0.891	8.22	112.1	0.892	7 28	112.3	0.890
1896	0.52	95.7	1 045	0.47	103.5	0.966	0.39	121.6	0.823	7.77	106 0	0.943	6.88	106.1	0.943
1897	0.49	90 0	1.111	0 37	80.1	1.249	0.28	85.9	1.164	7.31	99.7	1.003	6 48	100.0	1.000
1898	0.49	90 6	1.104	0.42	90 8	1.101	0 33	103.1	0.970	7.25	98 9	1.011	6 41	98.9	1.011
1899	0 63	117.0	0.855	0 52	113.6	0.881	0.38	117.5	0.851	9 83	134.1	0.746	8.69	134.1	0 746
1900	0.66	121 5	0 823	0 54	119.0	0 840	0.41	129.4	0.773	10 13	138.2	0.724	8.97	138 4	0 723
1901	0 70	129 0	0.775	0.53	116.4	0.859	0.41	126.9	0.788	10.83	147.7	0.677	9.57	147.7	0 677
1902	0 66	121 5	0.823	0 46	99.6	1 004	0 35	109 7	0.912	9 77	133.3	0.750	8.62	133.0	0.752
1903	0.60	104 2	0 959	0.56	122.1	0.819	0.43	135 0	0.741	8 64	117.9	0.848	7 63	117 7	0.850
1904	0 54	100 0	1.000	0.44	96 1	1 041	0 32	98 8	1.013	7.55	103.0	0.971	6.68	103.1	0.970
1905	0.56	104 1	0 961	0.46	100 7	0.993	0.32	100 3	0 997	7.90	107.8	0.928	6.97	107.6	0 929
1906	0 58	108 1	0.925	0 50	109.6	0 912	0.33	101 6	0.985	8.22	112.1	0.892	7 28	112.3	0.890
1907	0.60	111 2	0.899	0.54	119.0	0 840	0.33	103.4	0.967	8.72	119 0	0.840	7.72	119.1	0.840
1908	0 59	109.3	0 915	0 40	87.5	1.143	0.28	88.8	1.127	8 29	113 1	0 884	7.34	113 3	0.883
1909	0.57	105 3	0.950	0.43	93.2	1.073	0.31	95.6	1.046	7.81	106 5	0.939	6.92	106.8	0.937
1910	0.58	107 0	0.934	0.47	102 2	0 979	0.35	108.4	0 922	7 90	107 8	0.928	6 97	107.6	0.929
1911	0 54	100 0	1.001	0.44	95.2	1.051	0.32	100.9	0.991	7.14	97.4	1.027	6.31	97 4	1.027
1912	0.55	101.3	0.987	0 48	104.6	0.956	0.32	99.7	1.003	7.18	98 0	1.020	6.35	98.0	1.020
1913	0 59	108 1	0.925	0.50	109.0	0.918	0.34	107·5	0.930	7 70	105 0	0.952	6.81	105.1	0.951
1914	0.54	100 0	1 000	0.46	100.0	1.000	0.32	100.0	1.000	7.33	100 0	1.000	6.48	100 0	1.000
1915	0 64	119 0	0 840	0.48	104.4	0 958	0 32	99.1	1.010	8.61	117 5	0.851	7.61	117 4	0.852
1916	0.78	144 0	0.694	0 70	152 3	0 657	0.42	131.9	0 758	11.07	151.0	0.662	9 79	151.1	0.662
1917	1.16	215.1	0.464	0 77	168.7	0.593	0.52	162.2	0.617	18.05	246 2	0.406	15 98	246.7	0.405
1918	1 00	184 4	0 542	0.75	164 1	0.609	0.52	163.4	0.612	14 43	196.9	0.508	12.76	196.9	0.508
1919	0 98	180 5	0 554	0 80	174.4	0.573	0.61	191 9	0 521	13.37	182 4	0 548	11.82	182 4	0.548
1920	1 24	228 7	0 437	0 82	180.1	0 555	0.67	208 4	0.480	16.69	227.7	0.439	14.77	227 9	0 439
1921	0.96	176.5	0.567	0 70	153 8	0 650	0 59	182 8	0.547	11 26	153.6	0.651	9 79	151 1	0.662
1922	0.86	158.5	0.631	0.71	155 1	0.645	0 58	182.2	0 549	10.16	138 6	0 721	8 80	135.8	0.736
1923	0.97	178.5	0.560	0.86	187.7	0.533	0 71	222.2	0.450	11.24	153.3	0.652	9.75	150.5	0.665

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Ventilators, 24-in. star			Cornices, copper			Flashing, copper			Gutters, copper			Leaders, copper		
	Cost of each	Per cent of 1914 cost	Reciprocal	Cost per 100 lin. ft.	Per cent of 1914 cost	Reciprocal	Cost per 100 sq. ft.	Per cent of 1914 cost	Reciprocal	Cost per 100 lin. ft.	Per cent of 1914 cost	Reciprocal	Cost per 100 lin. ft.	Per cent of 1914 cost	Reciprocal
1890	$5.59	77.6	1.288	$47.57	115.4	0.867	23.14	119.1	0.840	$20.55	110.5	0.905	$35.83	114.8	0.871
1891	5.53	76.8	1.302	40.05	97.1	1.030	19.36	99.6	1.004	17.46	93.9	1.065	30.19	96.8	1.033
1892	5.48	76.1	1.314	34.06	82.6	1.211	16.36	84 2	1.188	14.98	80.5	1.242	25.70	82.4	1.214
1893	5.40	75.0	1.333	32.06	77.8	1.286	15.36	79.1	1.265	14.15	76.1	1.315	24.20	77.6	1.289
1894	5.11	71.0	1.409	30.65	74.3	1.345	14 66	75.5	1.325	13.56	72.9	1.372	23.14	74.2	1.348
1895	5.20	72.2	1.385	30.67	74.4	1.345	14.66	75.5	1.325	13 58	73.0	1.370	23.16	74 2	1.347
1896	5.18	71.9	1.390	30.72	74.5	1.342	14.67	75.5	1.324	13.62	73.2	1.366	23.20	74.4	1.345
1897	5.11	71.0	1.409	31.37	76.1	1.315	14.98	77.1	1.297	13.91	74.8	1.337	23.69	75 9	1.317
1898	5.07	70.4	1.420	30.15	73.1	1.368	14 37	74 0	1.352	13 39	72.0	1.390	22.77	73 0	1.370
1899	5.84	81.1	1.233	45.82	111.1	0.900	22.19	114 2	0.876	19.92	107.1	0.934	34 53	110 7	0.904
1900	6.15	85.4	1.171	43 76	106.1	0.942	21.11	108 6	0.920	19.13	102.8	0.972	33.00	105 8	0.945
1901	6.44	89.4	1.118	44 23	107.3	0.932	21.32	109.7	0.911	19.36	104.1	0.961	33.36	106.9	0.935
1902	6.40	88.9	1.125	38.19	92.6	1.080	18.25	93.9	1.065	16 91	90.9	1.100	28 84	92 4	1.082
1903	6.39	88.8	1.127	41.18	99.9	1.001	19.68	101.3	0.987	18.23	98 0	1.020	31.09	99.7	1.004
1904	6.14	85.3	1.173	38.80	94.1	1.063	18 49	95.2	1.051	17.25	92.7	1.078	29.31	93 9	1.065
1905	6.35	88.2	1.134	42.68	103.5	0.966	20 40	105 0	0.952	18.90	101.6	0.984	32.23	103.3	0.968
1906	6.51	90.4	1.106	50.53	122.6	0.816	24.31	125 1	0.799	22.17	119.2	0.839	38.12	122.2	0.818
1907	6.62	91.9	1.088	58.73	142.4	0.702	28.41	146 2	0.684	25.58	137.5	0.727	44 27	141.9	0.705
1908	6.62	91.9	1.088	38.80	94.1	1.063	18 42	94 8	1.055	17.34	93.2	1.073	29.33	94 0	1.064
1909	6.62	91.9	1.088	38 87	94.3	1.061	18.43	94.9	1.054	17.40	93.5	1.069	29.39	94.2	1.062
1910	6.81	94.6	1.057	39.19	95.1	1.052	18 56	95.5	1.047	17.58	94 5	1.058	29 64	95 0	1.053
1911	6.68	92 8	1.078	36.42	88.3	1 132	17.16	88.3	1 132	16 44	88 4	1.131	27 56	88.3	1.132
1912	6.83	94.9	1.054	45 92	111.4	0.898	21.88	112.6	0.888	20 42	109 8	0.911	34.69	111 2	0.899
1913	7.23	100.4	0.996	45 89	111.3	0.899	21.81	112 3	0.891	20.48	110.1	0.908	34.68	111.2	0.900
1914	7.20	100 0	1.000	41 23	100.0	1.000	19.43	100 0	1.000	18 60	100.0	1.000	31 20	100.0	1.000
1915	7.77	107 9	0.927	48.70	118 1	0.847	23.14	119 1	0.840	21 74	116 9	0.856	36 81	118.0	0.848
1916	8 47	117 6	0.850	75 54	183 2	0.546	36.55	188 1	0.532	32.89	176.8	0.566	56.94	182.5	0.548
1917	10 54	146 4	0.683	82.11	199.2	0.502	39.78	204 7	0.488	35.68	191 8	0.521	61.88	198.3	0.504
1918	10.46	145.3	0.688	72.08	174 8	0.572	34.58	178.0	0.562	31.75	170.7	0.586	54.40	174.4	0.574
1919	11 21	155.7	0.642	62.15	150.7	0.664	29.40	151.3	0.661	27 92	150.1	0.666	47.01	150.7	0.664
1920	14.45	200.7	0.498	63.53	154.1	0.649	29.57	152.2	0.657	29.13	156.6	0.639	48.16	154.4	0.648
1921	13 61	189 0	0.529	47.91	116 2	0.861	21.64	111.4	0.898	22.80	122.6	0.816	36.47	116.9	0.856
1922	12 23	169.9	0.589	46.98	114 0	0.878	21.41	110 1	0.908	22.12	118.9	0.841	35.72	114.5	0.873
1923	14.00	194.4	0 514	53.93	130.9	0.764	24.58	126.5	0.791	25.42	136.7	0.732	41.03	131.5	0.761

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Cornices, galvanized steel			Flashing, galvanized steel			Gutters, galvanized steel			Leaders, galvanized steel		
	Cost per 100 lin. ft.	Per cent of 1914 cost	Recip-rocal	Cost per 100 sq. ft.	Per cent of 1914 cost	Recip-rocal	Cost per 100 lin. ft.	Per cent of 1914 cost	Recip-rocal	Cost per 100 lin. ft.	Per cent of 1914 cost	Recip-rocal
1890	$13.76	122.0	0.820	$ 7.21	141.7	0.706	$ 5.56	100.2	0.998	$ 8.62	114.5	0.874
1891	13.04	115.6	0.865	6.76	132.8	0.753	5.35	96.4	1.037	8.20	108.9	0.918
1892	12.71	112.7	0.888	6.56	128.9	0.776	5.25	94.6	1.057	8.02	106.5	0.939
1893	12.39	109.8	0.910	6.38	125.3	0.798	5.14	92.6	1.080	7.82	103.9	0.963
1894	11.10	98.4	1.016	5.63	110.6	0.904	4.71	84.9	1.178	7.06	93.8	1.067
1895	11.46	101.6	0.984	5.83	114.5	0.873	4.83	87.0	1.149	7.27	96.6	1.036
1896	10.98	97.3	1.027	5.53	108.6	0.920	4.70	84.7	1.181	7.00	93.0	1.076
1897	10.49	93.0	1.075	5.23	102.8	0.973	4.56	82.2	1.217	6.72	89.2	1.121
1898	10.38	92.0	1.087	5.16	101.4	0.987	4.51	81.3	1.231	6.65	88.3	1.132
1899	13.47	119.4	0.837	6.95	136.5	0.732	5.58	100.5	0.995	8.50	112.9	0.886
1900	13.98	123.9	0.807	7.18	141.1	0.709	5.82	104.9	0.954	8.84	117.4	0.852
1901	14.84	131.6	0.760	7.65	150.3	0.665	6.14	110.6	0.904	9.37	124.4	0.804
1902	13.75	121.9	0.820	6.95	136.5	0.732	5.86	105.6	0.947	8.76	116.3	0.860
1903	12.63	112.0	0.893	6.22	122.2	0.818	5.58	100.5	0.995	8.14	108.1	0.925
1904	11.39	101.0	0.990	5.50	108.1	0.925	5.17	93.2	1.074	7.39	98.1	1.019
1905	11.86	105.1	0.951	5.73	112.6	0.888	5.38	96.9	1.032	7.71	102.4	0.977
1906	12.32	109.2	0.916	5.98	117.5	0.851	5.55	100.0	1.000	7.98	106.0	0.944
1907	12.90	114.4	0.874	6.32	124.2	0.805	5.74	103.4	0.967	8.32	110.5	0.905
1908	12.46	110.5	0.905	6.03	118.5	0.844	5.63	101.4	0.986	8.08	107.3	0.932
1909	11.98	106.2	0.942	5.72	112.4	0.890	5.50	99.1	1.009	7.81	103.7	0.964
1910	12.17	107.9	0.927	5.79	113.8	0.879	5.64	101.6	0.984	7.97	105.8	0.945
1911	11.33	100.4	0.996	5.28	103.7	0.964	5.36	96.6	1.035	7.47	99.2	1.008
1912	11.48	101.8	0.983	5.33	104.7	0.955	5.46	98.4	1.016	7.58	100.7	0.993
1913	12.25	108.6	0.921	5.71	112.2	0.892	5.80	104.5	0.957	8.07	107.2	0.933
1914	11.28	100.0	1.000	5.09	100.0	1.000	5.55	100.0	1.000	7.53	100.0	1.000
1915	13.53	119.9	0.834	6.36	125.0	0.800	6.33	114.1	0.877	8.88	117.9	0.848
1916	16.45	145.8	0.686	8.05	158.2	0.632	7.33	132.1	0.757	10.63	141.2	0.708
1917	24.79	219.8	0.455	12.85	252.5	0.396	10.19	183.6	0.545	15.61	207.3	0.482
1918	21.11	187.1	0.534	10.47	205.7	0.486	9.24	166.5	0.601	13.54	179.8	0.556
1919	20.54	182.1	0.549	9.87	193.9	0.516	9.39	169.2	0.591	13.38	177.7	0.563
1920	26.02	230.7	0.434	12.41	243.8	0.410	11.99	216.0	0.463	17.00	225.8	0.443
1921	19.82	175.7	0.569	8.64	169.7	0.589	10.03	180.7	0.553	13.27	176.2	0.567
1922	17.78	157.6	0.634	7.75	152.3	0.657	9.01	162.3	0.616	11.93	158.4	0.631
1923	20.02	177.5	0.563	8.65	169.9	0.588	10.22	184.1	0.543	13.45	178.6	0.560

BUILDING COST DATE-FACTOR DATA.—(*Continued*)

Year	Roofing, composition in place			Hardware, rough			Hardware, engine house doors			Hardware, finish	
	Cost per square	Per cent of 1914 cost	Reciprocal	Cost per hundredweight	Per cent of 1914 cost	Reciprocal	Cost per 100 lb.	Per cent of 1914 cost	Reciprocal	Per cent of 1914 cost	Reciprocal
1890	$ 4.48	92.0	1.087	$2.97	176.8	0.566	$ 4.17	59.6	1.679	$ 73.0	1.370
1891	4.48	92.0	1.087	2.47	147.0	0.680	4.09	58.4	1.711	73.0	1.370
1892	4.48	92.0	1.087	2.19	130.4	0.767	4.04	57.7	1.733	69.1	1.447
1893	4.48	92.0	1.087	1.99	118.5	0.844	3.88	55.4	1.804	69.5	1.439
1894	4.48	92.0	1.087	1.65	98.2	1.018	3.38	48.3	2.071	68.5	1.460
1895	4.48	92.0	1.087	2.12	126.2	0.792	3.58	51.1	1.955	73.7	1.357
1896	4.48	92.0	1.087	2.93	174.4	0.573	3.57	51.0	1.961	72.9	1.372
1897	4.48	92.0	1.087	1.49	88.7	1.128	3.61	51.6	1.939	69.1	1.447
1898	4.48	92.0	1.087	1.44	85.7	1.167	3.62	51.7	1.934	65.7	1.522
1899	4.48	92.0	1.087	2.39	142.3	0.703	4.46	63.7	1.570	65.7	1.522
1900	4.48	92.0	1.087	2.63	156.6	0.639	4.62	66.0	1.515	77.6	1.289
1901	4.48	92.0	1.087	2.37	141.1	0.709	4.95	70.7	1.414	75.1	1.332
1902	4.48	92.0	1.087	2.10	125.0	0.800	5.59	79.9	1.252	83.5	1.198
1903	4.48	92.0	1.087	2.08	123.8	0.808	5.62	80.3	1.246	86.1	1.161
1904	4.48	92.0	1.087	1.91	113.7	0.880	5.67	81.0	1.235	92.1	1.086
1905	4.48	92.0	1.087	1.90	113.1	0.884	6.00	85.7	1.167	119.7	0.835
1906	4.48	92.0	1.087	1.96	116.7	0.857	6.02	86.0	1.163	138.0	0.725
1907	4.48	92.0	1.087	2.12	126.2	0.792	6.29	89.9	1.113	133.4	0.750
1908	4.48	92.0	1.087	2.10	125.0	0.800	6.04	86.3	1.159	128.8	0.776
1909	4.48	92.0	1.087	1.92	114.3	0.875	6.18	88.3	1.133	127.9	0.782
1910	4.48	92.0	1.087	1.89	112.5	0.889	6.30	90.0	1.111	144.3	0.693
1911	4.48	92.0	1.087	1.80	107.1	0.933	6.12	87.4	1.144	92.0	1.087
1912	4.48	92.0	1.087	1.74	103.6	0.966	6.48	92.6	1.080	100.0	1.000
1913	4.03	82.8	1.208	1.82	108.3	0.923	6.97	99.6	1.004	100.0	1.000
1914	4.87	100.0	1.000	1.68	100.0	1.000	7.00	100.0	1.000	100.0	1.000
1915	5.02	103.1	0.970	1.75	104.2	0.960	7.15	102.1	0.979	117.1	0.854
1916	6.07	124.6	0.803	2.60	154.8	0.646	8.79	125.6	0.796	180.5	0.554
1917	7.03	144.4	0.693	3.63	216.1	0.463	10.53	150.4	0.665	272.1	0.368
1918	8.05	165.3	0.605	3.60	214.3	0.460	11.39	162.7	0.615	307.6	0.325
1919	10.58	217.2	0.460	3.52	209.5	0.477	11.40	162.9	0.614	319.6	0.313
1920	12.33	253.2	0.395	4.20	250.0	0.400	14.36	205.1	0.487	398.8	0.251
1921	11.65	239.2	0.418	3.07	182.7	0.547	12.55	179.3	0.558	286.0	0.350
1922	11.65	239.2	0.418	2.53	150.6	0.664	11.31	161.6	0.619	255.4	0.392
1923	12.54	257.5	0.392	2.92	173.8	0.575	12.89	184.1	0.543	313.9	0.318

ESTIMATED AVERAGE COST OF A TYPICAL 22- BY 55-FT. FRAME COMBINATION FREIGHT & PASSENGER STATION.

Item	Quantity	Unit	1890		1891		1892		1893		1894	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	31.38	Bbl.	$ 2.18	$ 68.41	$ 2.18	$ 68.41	$ 2.18	$ 68.41	$ 2.46	$ 77.19	$ 2.03	$ 63.70
Lime	0.06	Bbl.	1.00	0.06	0.94	0.06	0.96	0.06	0.96	0.06	0.87	0.05
Sand	12.48	Cu. yd.	0.69	8.61	0.69	8.61	0.69	8.61	0.73	9.11	0.72	8.99
Stone	24.36	Cu. yd.	0.91	22.17	0.91	22.17	0.91	22.17	0.96	23.39	0.96	23.39
Common brick	0.350	M. brk	7.09	2.48	6.24	2.18	6.30	2.21	6.36	2.23	5.52	1.93
Framing—simple, Y.P.	15.572	M.B.M.	20.62	321.09	19.31	300.70	18.19	283.25	17.82	277.49	17.46	271.89
Sheathing, hemlock	6.140	M.B.M.	18.86	115.80	17.66	108.43	16.63	102.11	16.30	100.08	15.96	97.99
Sheathing—D. & M. interior	6.200	M.B.M.	26.95	167.09	25.79	159.90	24.44	151.53	24.19	149.98	22.58	140.00
Flooring—1 in. Y.P. D. & M.	0.850	M.B.M.	34.58	29.39	33.09	28.13	31.36	26.66	31.03	26.38	28.97	24.62
Flooring—2 in. Y.P. D. & M.	1.100	M.B.M.	34.58	38.04	33.09	36.40	31.36	34.50	31.03	34.13	28.97	31.87
Trim, W.P. moulded	17.30	C.L.F.	0.99	17.13	0.90	15.57	0.90	15.57	0.88	15.22	0.76	13.15
Nails	13.63	Cwt.	2.97	40.48	2.47	33.67	2.19	29.85	1.99	27.12	1.65	22.49
Building paper	4.78	Rolls	0.95	4.54	0.68	3.26	0.57	2.73	0.54	2.58	0.52	2.49
Shingles, 16 in.	24.27	M.	2.66	64.56	2.66	64.56	2.66	64.56	2.66	64.56	2.37	57.52
Drop siding	0.520	M.B.M.	26.05	13.55	23.61	12.28	24.07	12.52	24.50	12.74	24.39	12.68
Clapboards	2.440	M.B.M.	26.05	63.56	23.61	57.61	24.07	58.73	24.50	59.78	24.39	59.51
Windows	265.00	Sq. ft.	0.24	63.60	0.22	58.30	0.22	58.30	0.22	58.30	0.19	50.35
Doors	187.00	Sq. ft.	0.26	48.62	0.24	44.88	0.24	44.88	0.24	44.88	0.21	39.27
Gutter lining, No. 22 G.I.	3.38	Cwt.	4.87	16.46	4.54	15.35	4.40	14.87	4.27	14.43	3.74	12.64
Leaders, 5 in. diam., No. 26 G.I.	0.64	C.L.F.	6.99	4.47	6.51	4.17	6.32	4.04	6.12	3.92	5.37	3.44
Miscellaneous iron	1.06	Cwt.	2.05	2.17	1.90	2.01	1.87	1.98	1.70	1.80	1.34	1.42
Paint—lead and oil	28.31	Gal.	1.20	33.97	1.13	31.99	1.09	30.86	1.07	30.29	1.00	28.31
Varnish	2.78	Gal.	0.75	2.09	0.67	1.86	0.57	1.58	0.56	1.56	0.56	1.56
Total cost of material				$1,148.34		$1,080.50		$1,039.98		$1,037.22		$ 969.26
Laborers, excavating	175.78	Hr.	0.155	27.32	0.157	27.54	0.157	27.58	0.163	28.65	0.162	28.55
Laborers, building	555.46	Hr.	0.161	89.54	0.163	90.54	0.163	90.37	0.162	89.76	0.162	89.71
Bricklayers	8.39	Hr.	0.443	3.72	0.451	3.79	0.452	3.79	0.447	3.75	0.448	3.76
Carpenters	1,181.43	Hr.	0.293	345.33	0.298	351.59	0.302	356.67	0.308	363.53	0.303	358.45
Ornamental iron workers	2.20	Hr.	0.243	0.54	0.251	0.55	0.249	0.55	0.251	0.55	0.234	0.51
Sheet metal workers	26.75	Hr.	0.286	7.64	0.297	7.95	0.298	7.98	0.298	7.98	0.297	7.94
Painters	130.81	Hr.	0.285	37.29	0.287	37.59	0.291	38.09	0.296	38.75	0.294	38.41
Total cost of labor				$ 511.38		$ 519.55		$ 525.03		$ 532.97		$ 527.33
Grand total				$1,659.72		$1,600.05		$1,565.01		$1,570.19		$1,496.59
Per cent of 1914 cost				73.16		70.53		68.99		69.21		65.98
Reciprocal				1.367		1.418		1.449		1.445		1.516

ESTIMATED AVERAGE COST OF A TYPICAL 22-BY 55-FT. FRAME COMBINATION FREIGHT & PASSENGER STATION.
(*Continued*)

Item	Quantity	Unit	1895		1896		1897		1898		1899	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	31.38	Bbl.	$ 1.69	$ 53.03	$ 1.73	$ 54.29	$ 1.69	$ 53.03	$ 1.72	$ 53.97	$ 1.77	$ 55 54
Lime	0.06	Bbl.	0 81	0.05	0.72	0 04	0.75	0.05	0.77	0.05	0.82	0.05
Sand	12.48	Cu. yd.	0.73	9.11	0.73	9.11	0.74	9.24	0.80	9.98	0.80	9 98
Stone	24.36	Cu. yd.	0 95	23.14	0.96	23.39	0.97	23.62	1.04	25.33	1.04	25.33
Common brick	0.350	M. brk.	5.83	2.04	5.59	1.96	5.47	1.91	6.28	2.20	6.21	2.17
Framing—simple, Y.P.	15.572	M.B.M.	16.46	256.32	17.22	268 15	16.93	263.63	16.91	263.32	19.71	306.92
Sheathing, hemlock	6.140	M.B.M.	15.05	92.41	15.75	96.71	15.48	95.05	15.46	94 92	18.02	110 64
Sheathing—D. & M. interior	6.200	M.B.M.	19.91	123.44	18.21	112.90	17.12	106.14	17 86	105.77	24.19	149 98
Flooring—1 in. Y.P. D. & M.	0.850	M.B.M.	25.55	21.72	23.37	19 86	21.96	18.67	21.88	18.60	31.03	26.38
Flooring—2 in. Y.P. D. & M.	1.100	M.B.M.	25 55	28.11	23.37	25.71	21.96	24.16	21.88	24.07	31.03	34 13
Trim, W.P. moulded	17.30	C.L.F.	0.66	11 42	0.60	10 38	0 59	10 21	0.67	11 59	0.93	16 09
Nails	13.63	Cwt.	2.12	28 90	2.93	39 94	1.49	20.31	1.44	19 63	2 39	32.58
Building paper	4 78	Rolls	0 53	2.54	0.55	2 63	0 53	2.54	0.52	2.49	0.90	4 31
Shingles, 16 in.	24.27	M.	2.17	52.67	2.19	53 15	2.29	55.58	2.42	58.73	2.49	60 43
Drop siding	0.520	M.B.M.	21.77	11.32	20.85	10 84	20.82	10.83	20.71	10 77	23.72	12 33
Clapboards	2.440	M.B.M.	21.77	53.12	20.85	50 87	20 82	50.80	20.71	50.53	23.72	57 87
Windows	265.00	Sq. ft	0 17	45.05	0.16	42 40	0.16	42.40	0.18	47.70	0.23	60.95
Doors	187.00	Sq. ft.	0.19	35 53	0.18	33 66	0.17	31 79	0.19	35.53	0.25	46 75
Gutter lining, No. 22 G.I.	3.38	Cwt.	3.88	13.11	3.66	12 37	3.44	11.63	3.40	11.49	4.65	15 72
Leaders, 5 in. diam. No. 26 G.I.	0.64	C.L.F.	5 56	3.56	5.25	3 36	4.93	3.16	4.88	3.12	6.67	4 27
Miscellaneous iron	1.06	Cwt.	1.44	1.53	1 40	1 48	1 31	1.39	1.28	1.36	2.07	2 19
Paint—lead and oil	28.31	Gal.	1.01	28.59	0.91	25 76	0 91	25.76	0.95	26 89	1 01	28 59
Varnish	2.78	Gal.	0.56	1.56	0.50	1 39	0 51	1 42	0.57	1 58	0.78	2 17
Total cost of material				$ 898.27		$ 900.35		$ 863 32		$ 879.62		$1,065 37
Laborers, excavating	175.78	Hr.	0.163	28.62	0 165	28 92	0.167	29 43	0.182	31.96	0.181	31 83
Laborers, building	555 46	Hr.	0.161	89 15	0 161	89 54	0.162	90.10	0.163	90.54	0.162	89 93
Bricklayers	8 39	Hr.	0.449	3.77	0.450	3 77	0.443	3 72	0.437	3 67	0.461	3 87
Carpenters	1,181.43	Hr.	0.295	348 40	0.297	350.88	0.297	359.29	0.307	362 46	0.315	372 03
Ornamental iron workers	2 20	Hr.	0.246	0.54	0.249	0.55	0 264	0 58	0.268	0.59	0.274	0.60
Sheet metal workers	26 75	Hr.	0.300	8.01	0.308	8 23	0.314	8.40	0.311	8 32	0.321	8.59
Painters	130 81	Hr.	0.292	38.24	0.294	38.43	0.294	38.47	0.297	38.89	0.305	39.91
Total cost of labor				$ 516 73		$ 520.32		$ 520.99		$ 536.43		$ 546 76
Grand total				$1,415.00		$1,420.67		$1, 384.31		$1,416.05		$1,612.13
Per cent of 1914 cost				62.37		62 62		61.02		62.42		71.06
Reciprocal				1.603		1.597		1,639		1.602		1 407

ESTIMATED AVERAGE COST OF A TYPICAL 22- BY 55-FT. FRAME COMBINATION FREIGHT & PASSENGER STATION.
(Continued)

Item	Quantity	Unit	1900		1901		1902		1903		1904	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	31.38	Bbl.	$ 1.89	$ 59.31	$ 1.62	$ 50.84	$ 1.68	$ 52.72	$ 1.76	$ 55.23	$ 1.19	$ 37.34
Lime	0.06	Bbl.	0.71	0.04	0.80	0.05	0.84	0.05	0.82	0.05	0.86	0.05
Sand	12.48	Cu. yd.	0.82	10.23	0.85	10.60	0.88	10.98	0.88	10.88	0.89	11.11
Stone	24.36	Cu. yd.	1.07	26.07	1.11	27.04	1.17	28.50	1.18	28.74	1.19	28.99
Common brick	0.350	M. brk.	5.80	2.03	6.34	2.22	5.99	2.10	6.53	2.29	8.13	2.85
Framing, simple, Y.P.	15.572	M.B.M.	22.38	348.50	19.65	305.99	20.78	323.59	21.69	337.76	22.01	342.74
Sheathing, hemlock	6.140	M.B.M.	20.46	125.62	17.97	110.34	19.00	116.66	19.84	121.82	20.13	123.60
Sheathing, D. & M. interior	6.200	M.B.M.	21.78	135.04	24.54	152.15	25.25	156.55	25.21	156.30	25.21	156.30
Flooring, 1 in. Y.P. D. & M.	0.850	M.B.M.	27.94	23.75	31.48	26.76	32.39	27.53	32.35	27.50	32.35	27.50
Flooring, 2 in. Y.P. D. & M.	1.100	M.B.M.	27.94	30.73	31.48	34.63	32.39	35.63	32.35	35.59	32.35	35.59
Trim, W.P. moulded	17.30	C.L.F.	1.14	19.72	1.36	23.53	1.53	26.47	1.24	21.45	1.22	21.11
Nails	13.63	Kegs	2.63	35.85	2.37	32.30	2.10	28.62	2.08	28.35	1.91	26.03
Building paper	4.78	Rolls	0.99	4.74	0.57	2.73	0.54	2.58	0.68	3.25	0.63	3.01
Shingles, 16 in.	24.27	M.	2.52	61.16	2.69	65.29	2.99	72.57	2.74	66.50	2.60	63.10
Drop siding	0.520	M.B.M.	26.83	13.95	26.51	13.79	28.67	14.91	29.95	15.57	31.01	16.13
Clapboards	2.440	M.B.M.	26.83	65.47	26.51	64.68	28.67	69.95	29.95	73.08	31.01	75.66
Windows	265.00	Sq. ft.	0.27	71.55	0.33	87.45	0.35	92.97	0.29	76.85	0.29	76.85
Doors	187.00	Sq. ft.	0.30	56.10	0.35	65.45	0.39	72.93	0.33	61.71	0.32	59.84
Gutter lining, No. 22 G.I.	3.38	Cwt.	4.80	16.22	5.13	17.34	4.61	15.59	4.07	13.77	3.55	12.01
Leaders, 5 in. diam., No. 26 G.I.	0.64	C.L.F.	6.89	4.41	7.36	4.71	6.62	4.24	5.85	3.74	5.08	3.25
Miscellaneous iron	1.06	Cwt.	1.96	2.08	1.84	1.95	2.13	2.26	2.00	2.12	1.72	1.82
Paint, lead and oil	28.31	Gal.	1.21	34.26	1.15	32.56	1.09	30.86	1.09	30.86	1.06	30.01
Varnish	2.78	Gal.	0.85	2.36	0.70	1.95	0.84	2.34	0.95	2.64	0.96	2.67
Total cost of material				$1,149.9		$1,134.35		$1,190.38		$1,176.05		$1,157.56
Laborers, excavating	175.78	Hr.	0.185	32.55	0.191	33.57	0.197	34.65	0.199	34.89	0.200	35.09
Laborers, building	555.46	Hr.	0.170	94.59	0.178	98.65	0.187	103.70	0.193	107.09	0.195	108.15
Brick layers	8.39	Hr.	0.473	3.97	0.509	4.27	0.543	4.56	0.564	4.73	0.568	4.76
Carpenters	1,181.43	Hr.	0.348	411.02	0.361	426.97	0.389	459.58	0.414	488.52	0.406	479.78
Ornamental iron workers	2.20	Hr.	0.305	0.64	0.357	0.78	0.397	0.87	0.415	0.91	0.453	1.00
Sheet metal workers	26.75	Hr.	0.342	9.15	0.353	9.43	0.376	10.06	0.403	10.77	0.406	10.86
Painters	130.81	Hr.	0.318	41.55	0.328	42.94	0.347	45.34	0.467	47.94	0.378	49.38
Total cost of labor				$ 593.50		$ 616.61		$ 658.76		$ 694.85		$ 689.02
Grand total				$1,742.69		$1,750.96		$1,849.14		$1,870.90		$1,846.58
Per cent of 1914 cost				76.82		77.18		81.51		82.47		81.40
Reciprocal				1.302		1.296		1.227		1.213		1.229

ESTIMATED AVERAGE COST OF A TYPICAL 22- BY 55-FT. FRAME COMBINATION FREIGHT & PASSENGER STATION.
(*Continued*)

Item	Quantity	Unit	1905		1906		1907		1908		1909	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	31.38	Bbl.	$ 1.16	$ 36.40	$ 1.38	$ 43.30	$ 1.46	$ 45.81	$ 1.27	$ 39.85	$ 1.23	$ 38.60
Lime	0.06	Bbl.	0.92	0.06	0.98	0.06	0.99	0.06	1.08	0.06	1.08	0.06
Sand	12.48	Cu. yd.	0.89	11.11	0.95	11.86	0.99	12.36	1.09	13.60	1.09	13.60
Stone	24.36	Cu. yd.	1.20	29.23	1.21	29.48	1.23	29.96	1.24	30.21	1.25	30.45
Common brick	0.350	M. brk.	8.73	3.06	9.21	3.22	6.89	2.41	5.84	2.04	7.16	2.51
Framing, simple, Y.P.	15.572	M.B.M.	23.13	360.18	29.13	453.61	29.44	458.44	26.59	414.06	25.23	392.88
Sheathing, hemlock	6.140	M.B.M.	21.15	129.86	26.63	163.51	26.92	165.29	24.31	149.26	23.07	141.65
Sheathing, D. & M. interior	6.200	M.B.M.	26.21	162.50	31.54	195.55	32.18	199.52	32.25	199.95	31.99	198.34
Flooring, 1 in. Y.P. D. & M.	0.850	M.B.M.	33.63	28.59	40.47	34.40	41.29	35.10	41.37	35.16	41.05	34.89
Flooring, 2 in. Y.P. D. & M.	1.100	M.B.M.	33.63	36.99	40.47	44.52	41.29	45.42	41.37	45.51	41.05	45.16
Trim, W.P. moulded	17.30	C.L.F.	1.29	22.32	1.21	20.93	1.32	22.84	1.27	21.97	1.29	22.32
Nails	13.63	Kegs	1.90	25.90	1.96	26.71	2.12	28.90	2.10	28.62	1.92	26.17
Building paper	4.78	Rolls	0.57	2.73	0.56	2.68	0.57	2.73	0.57	2.73	0.55	2.63
Shingles, 16 in.	24.27	M.	2.60	63.10	3.03	73.54	3.64	88.34	3.12	75.72	3.10	75.24
Drop siding	0.520	M.B.M.	32.82	17.07	37.77	19.64	38.73	20.14	39.68	20.63	35.72	18.57
Clapboards	2.440	M.B.M.	32.82	80.08	37.77	92.16	38.73	94.50	39.68	96.82	35.72	87.16
Windows	265.00	Sq. ft.	0.31	82.15	0.31	82.15	0.33	87.45	0.31	82.15	0.31	82.15
Doors	187.00	Sq. ft.	0.36	67.32	0.35	65.45	0.37	69.19	0.36	67.32	0.36	67.32
Gutter lining, No. 22 G.I.	3.38	Cwt.	3.71	12.55	3.88	13.12	4.12	13.94	3.91	13.23	3.68	12.45
Leaders, 5 in. diam., No. 26 G.I.	0.64	C.L.F.	5.33	3.41	5.56	3.56	5.90	3.78	5.60	3.58	5.27	3.37
Miscellaneous iron	1.06	Cwt.	1.92	2.04	1.98	2.10	2.11	2.24	1.70	1.80	1.76	1.87
Paint, lead and oil	28.31	Gal.	1.14	32.27	1.18	33.41	1.20	33.97	1.14	32.27	1.22	34.54
Varnish	2.78	Gal.	1.05	2.92	1.10	3.06	1.05	2.92	0.78	2.17	0.87	2.42
Total cost of material				$1,211.84		$1,418.02		$1,465.31		$1,378.71		$1,334.35
Laborers, excavating	175.78	Hr.	0.201	35.30	0.215	37.72	0.222	39.09	0.247	43.40	0.247	43.40
Laborers, building	555.46	Hr.	0.193	107.26	0.203	112.65	0.226	125.26	0.228	126.42	0.239	132.81
Brick layers	8.39	Hr.	0.594	4.98	0.604	5.06	0.607	5.09	0.612	5.14	0.616	5.17
Carpenters	1,181.43	Hr.	0.427	503.88	0.441	521.25	0.465	549.01	0.466	550.07	0.477	562.95
Ornamental iron workers	2.20	Hr.	0.468	1.03	0.463	1.02	0.480	1.05	0.498	1.10	0.507	1.12
Sheet metal workers	26.75	Hr.	0.418	11.18	0.425	11.37	0.424	11.34	0.434	11.62	0.445	11.90
Painters	130.81	Hr.	0.388	50.74	0.398	52.05	0.415	54.22	0.420	54.87	0.425	55.57
Total cost of labor				$ 714.37		$ 741.12		$ 785.06		$ 792.62		$ 812.92
Grand total				$1,926.21		$2,159.14		$2,250.37		$2,171.33		$2,147.27
Per cent of 1914 cost				84.95		95.17		99.20		95.71		94.65
Reciprocal				1.177		1.051		1.008		1.045		1.057

ESTIMATED AVERAGE COST OF A TYPICAL 22- BY 55-FT. FRAME COMBINATION FREIGHT & PASSENGER STATION.
(Continued)

Item	Quantity	Unit	1910		1911		1912		1913		1914	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	31.28	Bbl.	$ 1.26	$ 39.54	$ 1.20	$ 37.66	$ 1.06	$ 33.26	$ 1.32	$ 41.42	$ 1.32	$ 41.42
Lime	0.06	Bbl.	1.08	0.06	1.15	0.07	1.13	0.07	1.12	0.07	1.07	0.06
Sand	12.48	Cu. yd.	1.16	14.48	1.16	14.48	1.22	15.23	1.24	15.48	1.25	15.60
Stone	24.36	Cu. yd.	1.26	30.69	1.27	30.94	1.29	31.42	1.43	34.83	1.58	38.49
Common brick	0.350	M. brk.	6.51	2.28	6.70	2.35	7.60	2.66	7.64	2.67	7.05	2.47
Framing, simple, Y.P.	15.572	M.B.M.	25.67	399.73	26.20	407.99	27.16	422.94	28.03	436.48	26.17	407.52
Sheathing, hemlock	6.140	M.B.M.	23.48	144.17	23.95	147.05	24.84	152.52	25.63	157.37	23.93	146.93
Sheathing, D. & M., interior	6.200	M.B.M.	31.80	197.16	31.12	192.94	31.73	196.73	33.92	210.30	32.12	199.14
Flooring, 1 in. Y.P., D. & M.	0.850	M.B.M.	40.80	34.68	39.93	33.94	40.72	34.61	43.52	36.99	41.21	35.03
Flooring, 2 in. Y.P., D. & M.	1.100	M.B.M.	40.80	44.88	39.93	43.92	40.72	44.79	43.52	47.87	41.21	45.33
Trim, W.P., moulded	17.30	C.L.F.	1.22	21.11	1.17	20.24	1.10	19.03	1.14	19.72	1.13	19.55
Nails	13.63	Kegs	1.89	25.67	1.80	24.53	1.74	23.72	1.82	24.81	1.68	22.90
Building paper	4.78	Rolls	0.52	2.49	0.52	2.49	0.52	2.49	0.52	2.49	0.52	2.49
Shingles, 16 in.	24.27	M.	3.04	73.78	2.89	70.14	3.08	74.75	3.03	73.54	2.89	70.14
Drop siding	0.520	M.B.M.	35.79	18.61	35.72	18.57	35.61	18.52	36.92	19.20	35.40	18.41
Clapboards	2.440	M.B.M.	35.79	87.33	35.72	87.16	35.61	86.89	36.92	90.08	35.40	86.38
Windows	265.00	Sq. ft.	0.31	82.15	0.28	74.20	0.27	71.55	0.29	76.85	0.29	76.85
Doors	187.00	Sq. ft.	0.36	67.32	0.31	57.97	0.30	56.10	0.31	57.97	0.31	59.97
Gutter lining, No. 22 G.I.	3.38	Cwt.	3.71	12.55	3.35	11.33	3.37	11.40	3.62	12.25	3.16	10.69
Leaders, 5 in. diam. No. 26 G.I.	0.64	C.L.F.	5.33	3.41	4.81	3.08	4.84	3.10	5.19	3.32	4.53	2.90
Miscellaneous iron	1.06	Cwt.	1.85	1.96	1.64	1.74	1.75	1.86	1.92	2.04	1.59	1.69
Paint, lead and oil	28.31	Gal.	1.45	41.05	1.50	42.47	1.33	37.65	1.20	33.97	1.23	34.82
Varnish	2.78	Gal.	1.22	3.39	1.23	3.42	0.87	2.42	0.76	2.11	0.83	2.31
Total cost of material				$1,348.49		$1,328.68		$1,343.71		$1,401.83		$1,341.09
Laborers, excavating	175.78	Hr.	0.259	45.60	0.259	45.60	0.275	48.34	0.280	49.22	0.283	49.73
Laborers, building	555.46	Hr.	0.244	135.48	0.248	137.53	0.259	143.92	0.263	146.25	0.280	155.42
Bricklayers	8.39	Hr.	0.629	5.27	0.629	5.27	0.636	5.33	0.659	5.53	0.674	5.66
Carpenters	1,181.43	Hr.	0.495	584.93	0.500	590.72	0.509	601.82	0.522	617.06	0.538	635.14
Ornamental iron workers	2.20	Hr.	0.510	1.12	0.514	1.13	0.542	1.19	0.580	1.27	0.621	1.37
Sheet metal workers	26.75	Hr.	0.463	12.37	0.467	12.36	0.481	12.87	0.506	13.54	0.527	14.09
Painters	130.81	Hr.	0.442	57.80	0.458	59.85	0.469	61.28	0.486	63.60	0.502	65.65
Total cost of labor				$ 842.57		$ 852.46		$ 874.75		$ 896.47		$ 927.06
Grand total				$2,191.06		$2,181.14		$2,218.46		$2,298.30		$2,268.15
Per cent of 1914 cost				96.58		96.14		97.98		101.31		100.00
Reciprocal				1.035		1.040		1.022		0.987		1.000

ESTIMATED AVERAGE COST OF A TYPICAL 22- BY 55-FT. FRAME COMBINATION FREIGHT & PASSENGER STATION.
(*Continued*)

Item	Quantity	Unit	1915		1916		1917		1918		1919	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	31.38	Bbl.	$ 1.19	$ 37.34	$ 1.44	$ 45.19	$ 1.85	$ 58 04	$ 2.27	$ 71 23	$ 2.73	$ 85.67
Lime	0 06	Bbl.	1.28	0.08	1.45	0.09	1.82	0.11	2.38	0.14	2.76	0 17
Sand	12 48	Cu. yd.	1.27	15.85	1.35	16.85	1.56	19 47	1.87	23 34	2.01	25 08
Stone	24.36	Cu. yd.	1.58	38.49	1.78	43.36	2.33	56.76	3 98	96 95	3.68	89 64
Common brick	0.350	M. brk.	7.05	2.47	8.41	2.94	9.83	3 44	13.95	4.88	16 23	5 68
Framing, simple, Y.P.	15 572	M.B.M.	24.97	388 83	29 47	458.91	36.53	568 85	44.91	699 34	54.64	850.85
Sheathing, hemlock	6.140	M.B.M.	22.83	140 18	26.95	165 47	33 41	205.14	41.06	252 11	49.97	306.82
Sheathing, D. & M., interior	6.200	M.B.M.	30.03	186 19	32 57	201.93	38 67	239.75	37.47	232 31	55.25	342.55
Flooring, 1 in. Y.P., D. & M.	0.850	M.B.M.	38 53	32.75	41.79	35.52	49.62	42.18	48 09	40.88	70.88	60.25
Flooring, 2 in. Y.P., D. & M.	1.100	M.B.M.	38.53	42 38	41.79	45.96	49.62	54 58	48.09	52.90	70 88	77.97
Trim, W.P., moulded	17 30	C.L.F.	1.11	19.20	1.13	19 55	1.27	21 97	1.64	28 37	2.24	38.75
Nails	13 63	Kegs	1.75	23.85	2.60	35.44	3.63	49 48	3 60	49.07	3.52	47.98
Building paper	4 78	Rolls	0.52	2.49	0.70	3.35	0 79	3 78	0.92	4.40	0.96	4.59
Shingles, 16 in	24 27	M.	2 74	66 50	3 07	74.51	3 77	91 50	3.95	95 87	5 58	135.43
Drop siding	0.520	M.B.M.	34 62	18 00	33 88	17.62	45.03	23 42	53.56	27 85	63.08	32.80
Clapboards	2.440	M.B.M.	34 62	84.47	33.88	82.67	45.03	109.87	53.56	130.69	63.08	153.92
Windows	265 00	Sq. ft.	0.29	76 85	0.32	84.80	0.39	103 35	0.51	135 15	0.63	166.95
Doors	187.00	Sq. ft.	0.32	59 84	0.36	67.32	0.44	82.28	0.55	102.85	0.69	129.03
Gutter lining, No. 22, G.I.	3 38	Cwt.	4.06	13.73	5.25	17.76	8.63	29.18	6.87	23 23	6.36	21.51
Leaders, 5 in. diam. No. 26 G.I.	0 64	C.L.F.	5.82	3.72	7.54	4.82	12.38	7.92	9.84	6 30	9.12	5.84
Miscellaneous iron	1 06	Cwt.	1.74	1 84	3.27	3.47	4.58	4.85	4.55	4 82	3.74	3.96
Paint, lead and oil	28 31	Gal.	1.29	36 52	1.68	47.56	2.12	60 02	2.61	73 89	2.82	79.83
Varnish	2 78	Gal.	0.82	2 28	0 92	2.56	1 00	2 78	1.28	3 56	2.25	6.26
Total cost of material				$1,293 85		$1,477.65		$1,838.72		$2,160 13		$2,671.53
Laborers, excavating	175.78	Hr.	0.286	50.34	0.304	53.49	0.350	61 52	0.421	74 00	0.452	79.40
Laborers, building	555.46	Hr.	0.276	153.31	0.312	173.53	0.361	200 35	0.466	258.79	0.539	299.45
Bricklayers	8 39	Hr.	0.683	5.73	0.691	5.80	0.736	6 17	0.794	6.66	0.904	7 58
Carpenters	1,181 43	Hr.	0.549	648.72	0.565	667.86	0.621	734.02	0.678	801 48	0.779	919.86
Ornamental iron workers	2.20	Hr.	0.621	1.37	0.633	1.39	0.682	1.50	0.784	1.72	0.879	1.93
Sheet metal workers	26 75	Hr.	0.536	14 34	0.542	14.51	0 566	15.14	0.649	17.37	0.747	19.98
Painters	130 81	Hr.	0.503	65 77	0.533	69.66	0.562	73.48	0 647	84.57	0.740	96.83
Total cost of labor				$ 939.58		$ 986.24		$1,092.18		$1,244.59		$1,425.03
Grand total				$2,233.43		$2,463.89		$2,930.90		$3,404.72		$4,096.56
Per cent of 1914 cost				98.45		108.61		129.19		150.08		180.57
Reciprocal				1.016		0 921		0 774		0.666		0.554

ESTIMATED AVERAGE COST OF A TYPICAL 22- BY 55-FT. FRAME COMBINATION FREIGHT & PASSENGER STATION.
(Continued)

Item	Quantity	Unit	1920		1921		1922		1923	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	31.38	Bbl.	$ 3.44	$ 107.95	$ 2.67	$ 83.78	$ 2.36	$ 74.06	$ 2.50	$ 78.45
Lime	0.06	Bbl.	3.78	0.23	3.92	0.24	3.94	0.24	4.01	0.24
Sand	12.48	Cu. yd.	3.01	37.56	2.62	32.70	2.22	27.70	2.77	34.57
Stone	24.36	Cu. yd.	4.30	104.75	3.32	80.88	2.22	54.08	2.77	67.48
Common brick	0 350	M. brk.	25 06	8 77	20 32	7.11	18.34	6.42	21.27	7.44
Framing, simple, Y.P.	15 572	M.B.M.	64 64	1,006 57	50 06	779.53	50.06	779 53	54 25	844.78
Sheathing, hemlock	6.140	M.B.M.	59.11	362 94	45 78	281 10	45.78	281 09	49 61	304 60
Sheathing, D. & M., interior	6 200	M.B.M.	105.26	652 61	66 17	410 25	66.84	414 40	77.73	481.93
Flooring, 1 in. Y.P. D. & M.	0 850	M.B.M.	135.05	114.79	84.81	72 09	85 76	72 90	99.73	84 77
Flooring, 2 in. Y.P. D. & M.	1 100	M.B.M.	135 05	148 56	84.81	93 29	85.76	94 34	99 73	109 70
Trim, W.P., moulded	17 30	C.L.F.	3 60	62 28	2 30	39 79	2.70	46.71	3.23	55.88
Nails	13 63	Kegs	4.20	57.25	3.07	41.84	2.53	34 48	2.92	39 80
Building paper	4 78	Rolls	1.54	7.36	1.80	8 60	1.81	8 65	1 80	8 60
Shingles, 16 in.	24 27	M.	5.80	140.77	4.31	104.60	5.36	130 09	5 20	126.20
Drop siding	0 520	M.B.M.	113 95	59.25	72.99	37.95	83 90	43.63	90 59	47.11
Clapboards	2 440	M.B.M.	113.95	278 04	72.99	178.10	83.90	204.72	90 59	221 04
Windows	265.00	Sq. ft.	0 89	235 85	0 63	166.95	0 64	169.60	0 76	201.40
Doors	187 00	Sq. ft.	1.03	192 61	0.68	127 16	0 75	140 25	0 90	168.30
Gutter lining, No. 22 G.I.	3 38	Cwt.	7 97	26 95	5.25	17.76	4.71	15.92	5.23	17.68
Leaders, 5 in. diam. No. 26 G.I.	0 64	C.L.F.	11.44	7 32	7.40	4.74	6 66	4.26	7.37	4.72
Miscellaneous iron	1 06	Cwt.	4.76	5 05	2.97	3.15	2 61	2 77	3.31	3.51
Paint, lead and oil	28 31	Gal.	3.02	85 49	2.20	62 28	2.19	62.00	2.26	63.98
Varnish	2.78	Gal.	3.05	8.48	1.20	3.34	1.91	5.31	2.50	6.95
Total cost of material				$3,711 43		$2,637.23		$2,673.15		$2,979.13
Laborers, excavating	175 78	Hr.	0.677	119 00	0.590	103.69	0.4786	84.13	0.5754	101.14
Laborers, building	555 46	Hr.	0 697	386 99	0.687	381.66	0.5027	279 23	0.6312	350.61
Bricklayers	8.39	Hr.	1.166	9.78	1.227	10.29	1.1670	9.79	1.3250	11.12
Carpenters	1,181 43	Hr.	1 027	1,213.09	1 068	1,261.65	0.9582	1,132 05	1.0866	1,283.74
Ornamental iron workers	2.20	Hr.	1.100	2.42	1 098	2 42	0.9982	2.20	1.0990	2.42
Sheet metal workers	26 75	Hr.	0.975	26 08	1.030	27.56	0.9240	24.72	1.0669	28.54
Painters	130 81	Hr.	1 000	130 81	1.034	135 24	0.9175	120 02	1.0330	135.13
Total cost of labor				$1,888 17		$1,922 51		$1,652 14		$1,912.70
Grand total				$5,599 60		$4,559.74		$4,325.29		$4,891.83
Per cent of 1914 cost				246 83		200.99		190.69		215.67
Reciprocal				0.405		0.498		0 524		0 464

Estimated Average Cost of a Typical Brick Passenger Station

Item	Quantity	Unit	1890		1891		1892		1893		1894	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	330.5	Bbl.	$ 2.18	$ 720.49	$ 2.18	$ 720.49	$ 2.18	$ 720.49	$ 2.46	$ 813.03	$ 2.03	$ 670.92
Lime (300 lb.)	47.8	Bbl.	1.00	47.80	0.94	44.93	0.96	45.89	0.96	45.89	0.87	41.59
Sand	154.2	Cu. yd.	0.69	106.40	0.69	106.40	0.69	106.40	0.73	112.57	0.72	111.02
Crushed stone	176.7	Cu. yd.	0.69	121.92	0.69	121.92	0.69	121.92	0.73	128.99	0.72	127.22
Cinders	16.7	Cu yd.	0.44	7.35	0.45	7.52	0.43	7.18	0.42	7.01	0.41	6.85
Brick—common	65.3	M. brk.	7.09	462.98	6.24	407.47	6.30	411.39	6.36	415.31	5.52	360.46
Brick—face	22.8	M. brk.	18.67	425.68	18.68	425.90	17.26	393.53	17.46	398.09	16.44	374.83
Stone trim	806.0	Cu. ft.	0.68	548.08	0.68	548.08	0.68	548.08	0.68	548.08	0.68	548.08
Miscellaneous iron	35.8	Cwt.	2.05	73.39	1.90	68.02	1.87	66.95	1.70	60.86	1.34	47.97
Slate roofing	73.0	Sqr.	5.09	371.57	5.07	370.11	5.16	376.68	5.28	385.44	4.99	364.27
Simple framing—wood	45.4	M.B.M.	20.62	936.15	19.31	876.67	18.19	825.83	17.82	809.03	17.46	792.68
Interior sheathing	9.5	M.B.M.	26.95	256.02	25.79	245.00	24.44	232.18	24.19	229.80	22.58	214.51
Finish flooring	6.1	M.B.M.	34.58	210.94	33.09	201.85	31.36	191.30	31.03	189.28	28.97	176.72
Nails	25.2	Kegs	2.97	74.84	2.47	62.24	2.19	55.19	1.99	50.15	1.65	41.58
Windows	841.0	Sq. ft.	0.24	201.84	0.22	185.02	0.22	185.02	0.22	185.02	0.19	159.79
Doors	561.0	Sq. ft.	0.26	145.86	0.24	134.64	0.24	134.64	0.24	134.64	0.21	117.81
Wood mouldings—less than 5 in.	51.3	C.L.F.	0.99	50.79	0.90	46.17	0.90	46.17	0.88	45.14	0.76	38.99
Wood mouldings—5 in. and over	2.2	C.L.F.	2.45	5.39	2.23	4.91	2.23	4.91	2.19	4.82	1.87	4.11
Hemlock undersheathing	13.8	M.B.M.	18.86	260.27	17.66	243.71	16.63	229.49	16.30	224.94	15.96	220.25
Wood lath	8.9	M.	3.15	28.04	2.95	26.26	2.78	24.74	2.72	24.21	2.67	23.76
Y.P. trim	0.1	M.B.M.	26.95	2.70	25.79	2.58	24.44	2.44	24.19	2.42	22.58	2.26
Building paper	21.4	Rolls	0.95	20.33	0.68	14.55	0.57	12.20	0.54	11.56	0.52	11.13
Concrete forms	5.4	M.B.M.	20.62	111.35	19.31	104.27	18.19	98.23	17.82	96.23	17.46	94.28
Tile flooring	350.0	Sq. ft.	0.34	119.00	0.34	119.00	0.32	112.00	0.32	112.00	0.30	105.00
16 oz. copper flashing	9.9	Sqr.	23.14	229.09	19.36	191.66	16.36	161.96	15.36	152.06	14.66	145.13
16 oz. copper leaders	1.2	C.L.F.	35.83	43.00	30.19	36.23	25.70	30.84	24.20	29.04	23.14	27.77
Skylights—copper	30.0	Sq. ft.	0.706	21.18	0.662	19.86	0.553	16.59	0.543	16.29	0.463	13.89
Paint—lead and oil	60.8	Gal.	1.20	72.96	1.13	68.70	1.09	66.27	1.07	65.06	1.00	60.80
Paint—varnish	41.5	Gal.	0.75	31.12	0.67	27.80	0.57	23.66	0.56	23.24	0.56	23.24
Total cost of material				$5,706.53		$5,431.96		$5,252.17		$5,320.20		$4,926.91
Labor (excavating)	2,925.0	Hr.	0.1554	454.54	0.1567	458.35	0.1569	458.93	0.1630	476.78	0.1624	475.02
Labor (building)	2,029.0	Hr.	0.1612	327.07	0.1630	330.73	0.1627	330.12	0.1616	327.89	0.1615	327.68
Hod carrier	1,242.0	Hr.	0.2402	298.33	0.2407	298.95	0.2438	302.80	0.2421	300.69	0.2442	303.30
Brick layer	1,232.0	Hr.	0.4434	546.27	0.4514	556.12	0.4515	556.25	0.4468	550.46	0.4479	551.81
Carpenter	2,123.0	Hr.	0.2923	620.55	0.2976	631.80	0.3019	640.93	0.3077	653.25	0.3034	644.12
Slate roofer	212.0	Hr.	0.3224	68.35	0.3192	67.67	0.3198	67.80	0.3214	68.14	0.3144	66.65
Sheet metal worker	49.0	Hr.	0.2855	13.99	0.2972	14.56	0.2983	14.62	0.2984	14.62	0.2968	14.54
Painter	618.0	Hr.	0.2851	176.19	0.2874	177.61	0.2912	179.96	0.2962	183.05	0.2936	181.44
Plasterer	129.0	Hr.	0.3837	49.50	0.3822	49.30	0.3953	50.99	0.3959	51.07	0.3959	51.07
Tile setter	39.0	Hr.	0.3914	15.26	0.3945	15.38	0.4315	16.83	0.4337	16.91	0.4390	17.12
Cement mason	22.0	Hr.	0.3569	7.85	0.3538	7.78	0.3515	7.73	0.3512	7.73	0.3370	7.41
Lather—wood	49.0	Hr.	0.2865	14.04	0.2870	14.06	0.2866	14.04	0.2868	14.05	0.2875	14.09
Total cost of labor				$2,591.94		$2,622.31		$2,641.00		$2,664.64		$2,654.25
Grand total				$8,298.47		$8,054.27		$7,893.17		$7,984.84		$7,581.16
Per cent of 1914 cost				75.42		73.20		71.73		72.57		68.90
Reciprocal				1.326		1.366		1.394		1.378		1.451

ESTIMATED AVERAGE COST OF A TYPICAL BRICK PASSENGER STATION.—(*Continued*)

Item	Quantity	Unit	1895		1896		1897		1898		1899	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	330.5	Bbl.	$ 1.69	$ 558.54	$ 1.73	$ 571.77	$ 1.69	$ 558.54	$ 1.72	$ 568.46	$ 1.77	$ 584.99
Lime (300 lb.)	47.8	Bbl.	0.81	38.72	0.72	34.42	0.75	35.85	0.77	36.81	0.82	39.20
Sand	154.2	Cu. yd.	0.73	112.57	0.73	112.57	0.74	114.11	0.80	123.36	0.80	123.36
Crushed stone	176.7	Cu. yd.	0.73	128.99	0.73	128.99	0.74	130.76	0.80	141.36	0.80	141.36
Cinders	16.7	Cu. yd.	6.40	6.68	0.40	6.68	0.38	6.35	0.37	6.18	0.35	5.84
Brick—common	65.3	M. brk.	5.83	380.70	5.59	365.03	5.47	357.19	6.28	410.08	6.21	405.51
Brick—face	22.8	M. brk.	15.23	347.24	16.04	365.71	16.25	370.50	16.25	370.50	19.68	448.70
Stone trim	806.0	Cu. ft.	0.68	548.08	0.73	588.38	0.73	588.38	0.73	588.38	0.73	588.38
Miscellaneous iron	35.8	Cwt.	1.44	51.55	1.40	50.12	1.31	46.90	1.28	45.82	2.07	74.11
Slate roofing	73.0	Sqr.	5.01	365.73	4.85	354.05	4.69	342.37	5.35	390.55	4.70	343.10
Simple framing—wood	45.4	M.B.M.	16.46	747.28	17.22	781.79	16.93	768.62	16.91	767.71	19.71	894.83
Interior sheathing	9.5	M B.M	19.91	189.14	18.21	173.00	17 12	162.64	17.06	162.07	24.19	229.80
Finish flooring	6.1	M.B.M.	25 55	155.86	23.37	142.56	21.96	133.96	21.88	133.47	31.03	189.28
Nails	25.2	Kegs	2.12	53.42	2.93	73.84	1.49	37.55	1.44	36.29	2.39	60.23
Windows	841.0	Sq. ft.	0.17	142.97	0.16	134.56	0.16	134.56	0.18	151.38	0.23	193.43
Doors	561.0	Sq. ft.	0.19	106.59	0.18	100.98	0.17	95.37	0.19	106.59	0.25	140.25
Wood mouldings—less than 5 in.	51.3	C.L.F.	0.66	33.86	0.60	30.78	0.59	30.27	0.67	34.37	0.93	47.71
Wood mouldings—5 in. and over	2.2	C.L.F.	1.63	3.59	1.50	3.30	1.45	3.19	1.65	3.63	2.30	5.06
Hemlock undersheathing	13.8	M.B.M.	15.05	213.90	15.75	217.35	15.48	213.62	15.46	213.35	18.02	248.68
Wood lath	8.9	M.	2.52	22.43	2.63	23.41	2.59	23.05	2.58	22.96	3.01	26.78
Y.P. trim	0.1	M.B.M.	19.91	1.99	18.21	1.82	17.12	1.71	17.06	1.71	24.19	2.42
Building paper	21.4	Rolls	0.53	11.34	0.55	11.77	0.53	11.34	0.52	11.13	0.90	19.26
Concrete forms	5.4	M.B.M.	16.46	88.88	17.22	92 99	16.93	91.42	16.91	91 31	19.71	106.43
Tile flooring	350.0	Sq. ft.	0.28	98.00	0.30	105.00	0.30	105.00	0.30	105.00	0.36	126.00
16 oz. copper flashing	9.9	Sqr.	14.66	145.13	14.67	145.23	14.98	148.30	14.37	142.26	22.19	219 68
16 oz. copper leaders	1.2	C.L.F.	23.16	27.79	23.20	27.84	23.69	28.43	22.77	27.32	34.53	41.44
Skylights—copper	30.0	Sq. ft.	0.440	13.20	0.473	14.19	0.366	10.98	0.415	12.45	0.519	15.57
Paint—lead and oil	60.8	Gal.	1.01	61.41	0.91	55.33	0.91	55.33	0.95	57.76	1.01	61.40
Paint—varnish	41.5	Gal.	0.56	23.24	0.50	20.75	0.51	21.17	0.57	23.66	0.78	32.37
Total cost of material				$4,678.82		$4,733.31		$4,627.46		$4,785.92		$5,415.17
Laborer (excavating)	2,925.0	Hr.	0.1628	476.19	0.1645	481.16	0.1674	489.65	0.1818	531.76	0.1811	529.72
Laborer (building)	2,029.0	Hr.	0.1605	325.65	0.1612	327.07	0.1622	329.10	0.1630	330.73	0.1619	328.50
Hod carrier	1,242.0	Hr.	0.2410	299.42	0.2445	303.67	0.2414	299.82	0.2442	303.30	0.2495	309.88
Brick layer	1,232.0	Hr.	0.4489	553.04	0.4499	554.28	0.4432	546.02	0.4370	538.38	0.4612	568.20
Carpenter	2,123.0	Hr.	0.2949	626.07	0.2970	630.53	0.2965	629.47	0.3068	651.34	0.3149	668.53
Slate roofer	212.0	Hr.	0.3196	67.76	0.3192	67.67	0.3199	67.82	0.3268	69.28	0.3301	69.98
Sheet metal worker	49.0	Hr.	0.2995	14.68	0.3075	15.07	0.3141	15.39	0.3109	15.23	0.3211	15.73
Painter	618.0	Hr.	0.2923	180.64	0.2938	181.57	0.2941	181.75	0.2973	183.73	0.3051	188.55
Plasterer	129.0	Hr.	0.4059	52.36	0.4070	52.50	0.4069	52.49	0.4058	52.35	0.4240	54.70
Tile setter	39.0	Hr.	0.4442	17.32	0.4393	17.13	0.4452	17.36	0.4520	17.63	0.4527	17.66
Cement mason	22.0	Hr.	0.3366	7.40	0.3502	7.70	0.3512	7.73	0.3507	7.72	0.3578	7.87
Lather—wood	49.0	Hr.	0.2946	14.44	0.3182	15.59	0.3270	16.02	0.3332	16.33	0.3387	16.60
Total cost of labor				$2,634.97		$2,653.94		$2,652.62		$2,717.78		$2,775.92
Grand total				$7,313.79		$7,387.25		$7,280.08		$7,503.70		$8,191.09
Per cent of 1914 cost				66.47		67.14		66.16		68.19		74.44
Designer				1.50%		1.49%		1.51%		1.48%		1.36%

ESTIMATED AVERAGE COST OF A TYPICAL BRICK PASSENGER STATION.—(*Continued*)

Item	Quantity	Unit	1900		1901		1902		1903		1904	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	330.5	Bbl.	$ 1.89	$ 624.64	$ 1.62	$ 535.41	$ 1.68	$ 555.24	$ 1.76	$ 581.68	$ 1.19	$ 393.30
Lime (300 lb.)	47.8	Bbl.	0.71	33.94	0.80	38.24	0.84	40.15	0.82	39.20	0.86	41.11
Sand	154.2	Cu. yd.	0.82	126.44	0.85	131.07	0.88	135.70	0.88	135.70	0.89	137.24
Crushed stone	176.7	Cu. yd.	0.82	144.89	0.85	150.20	0.88	155.50	0.88	155.50	0.89	157.26
Cinders	16.7	Cu. yd.	0.41	6.85	0.43	7.18	0.43	7.18	0.44	7.35	0.44	7.35
Brick—common	65.3	M. brk.	5.80	378.74	6.34	414.00	5.99	391.15	6.53	426.41	8.13	530.89
Brick—face	22.8	M. brk.	20.95	477.66	20.99	478.57	21.43	488.60	22.69	517.33	23.31	531.47
Stone trim	806.0	Cu. ft.	0.88	709.28	0.88	709.28	0.88	709.28	0.88	709.28	0.88	709.28
Miscellaneous iron	35.8	Cwt.	1.96	70.17	1.84	65.87	2.13	76.25	2.00	71.60	1.72	61.58
Slate roofing	73.0	Sqr.	4.48	327.04	4.65	339.45	4.98	363.54	5.60	408.80	5.46	398.58
Simple framing—wood	45.4	M.B.M.	22.38	1,016.05	19.65	892.11	20.78	943.41	21.69	984.73	22.01	999.25
Interior sheathing	9.5	M.B.M.	21.78	206.91	24.54	233.13	25.25	239.88	25.21	239.50	25.21	239.50
Finish flooring	6.1	M.B.M.	27.94	170.43	31.48	192.03	32.39	197.58	32.35	197.34	32.35	197.34
Nails	25.2	Kegs	2.63	66.28	2.37	59.72	2.10	52.92	2.08	52.42	1.91	48.13
Windows	841.0	Sq. ft.	0.27	227.07	0.33	277.53	0.35	294.35	0.29	243.89	0.29	243.89
Doors	561.0	Sq. ft.	0.30	168.30	0.35	196.35	0.39	218.79	0.33	185.13	0.32	179.52
Wood mouldings—less than 5 in.	51.3	C.L.F.	1.14	58.48	1.36	69.77	1.53	78.49	1.24	63.61	1.22	62.59
Wood mouldings—5 in. and over	2.2	C.L.F.	2.84	6.25	3.37	7.41	3.78	8.32	3.08	6.78	3.02	6.64
Hemlock undersheathing	13.8	M.B.M.	20.46	282.35	17.97	247.99	19.00	262.20	19.84	273.79	20.13	277.79
Wood lath	8.9	M.	3.42	30.44	3.00	26.70	3.18	28.30	3.32	29.55	3.36	29.90
Y. P. trim	0.1	M.B.M.	21.78	2.18	24.54	2.45	25.25	2.52	25.21	2.52	25.21	2.52
Building paper	21.4	Rolls	0.99	21.19	0.57	12.20	0.54	11.56	0.68	14.55	0.63	13.48
Concrete forms	5.4	M.B.M.	22.38	120.85	19.65	106.11	20.78	112.21	21.69	117.13	22.01	118.85
Tile flooring	350.0	Sq. ft.	0.39	136.50	0.39	136.50	0.39	136.50	0.42	147.00	0.43	150.50
16 oz. copper flashing	9.9	Sqr.	21.11	208.98	21.32	211.07	18.25	180.68	19.68	194.83	18.49	183.05
16 oz. copper leaders	1.2	C.L.F.	33.00	39.60	33.36	40.03	28.84	34.61	31.09	37.31	29.31	35.17
Skylights—copper	30.0	Sq. ft.	0.544	16.32	0.532	15.96	0.455	13.65	0.558	16.74	0.439	13.17
Paint—lead and oil	60.8	Gal.	1.21	73.57	1.15	69.92	1.09	66.27	1.09	66.27	1.06	64.45
Paint—varnish	41.5	Gal.	0.85	35.28	0.70	29.05	0.84	34.86	0.95	39.42	0.96	39.84
Total cost of material				$5,786.68		$5,695.30		$5,839.69		$5,965.36		$5,873.64
Laborer (excavating)	2,925.0	Hr.	0.1852	541.71	0.1910	558.68	0.1971	576.52	0.1985	580.61	0.1996	583.83
Laborer (building)	2,029.0	Hr.	0.1703	345.54	0.1776	360.35	0.1867	378.81	0.1928	391.19	0.1947	395.05
Hod carrier	1,242.0	Hr.	0.2601	323.04	0.2642	328.14	0.2791	346.64	0.2953	366.76	0.2930	363.91
Brick layer	1,232.0	Hr.	0.4733	583.10	0.5088	626.84	0.5434	669.47	0.5643	695.22	0.5677	699.41
Carpenter	2,123.0	Hr.	0.3479	738.59	0.3614	767.25	0.3890	825.85	0.4135	877.86	0.4061	862.15
Slate roofer	212.0	Hr.	0.3561	75.49	0.3699	78.42	0.3903	82.74	0.4222	89.52	0.3905	82.79
Sheet metal worker	49.0	Hr.	0.3420	16.76	0.3527	17.28	0.3760	18.42	0.4026	19.73	0.4059	19.89
Painter	618.0	Hr.	0.3176	196.28	0.3283	202.89	0.3466	214.20	0.3665	226.50	0.3775	233.30
Plasterer	129.0	Hr.	0.4393	56.67	0.4660	60.11	0.4959	63.97	0.5267	67.94	0.5440	70.18
Tile setter	39.0	Hr.	0.4661	18.18	0.4922	19.20	0.4814	18.77	0.5032	19.62	0.5233	20.41
Cement mason	22.0	Hr.	0.3659	8.05	0.3865	8.50	0.4201	9.24	0.4453	9.80	0.4709	10.36
Lather—wood	49.0	Hr.	0.3507	17.19	0.3629	17.78	0.3782	18.53	0.3729	18.27	0.4203	20.59
Total cost of labor				$2,920.60		$3,045.44		$3,223.16		$3,363.02		$3,361.87
Grand total				$8,707.28		$8,740.74		$9,062.85		$9,328.38		$9,235.51
Per cent of 1914 cost				79.13		79.44		82.36		84.78		83.93
Reciprocal				1.264		1.259		1.214		1.180		1.191

ESTIMATED AVERAGE COST OF A TYPICAL BRICK PASSENGER STATION.—(*Continued*)

Item	Quantity	Unit	1905		1906		1907		1908		1909	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	330.5	Bbl.	$ 1.16	$ 383.38	$ 1.38	$ 456.09	$ 1.46	$ 482.53	$ 1.27	$ 419.74	$ 1.23	$ 406.52
Lime (300 lb.)	47.8	Bbl.	0.92	43.98	0.98	46.84	0.99	47.32	1.08	51.62	1.08	51.62
Sand	154.2	Cu. yd.	0.89	137.24	0.95	146.49	0.99	152.66	1.09	168.08	1.09	168.08
Crushed stone	176.7	Cu. yd.	0.89	157.26	0.95	167.87	0.99	174.93	1.09	192.60	1.09	192.60
Cinders	16.7	Cu. yd.	0.43	7.18	0.44	7.35	0.44	7.35	0.45	7.52	0.46	7.68
Brick—common	65.3	M. brk.	8.73	570.07	9.21	601.41	6.89	449.92	5.84	381.35	7.16	467.55
Brick—face	22.8	M. brk.	22.69	517.33	21.62	492.94	21.24	484.27	21.25	484.50	22.73	518.24
Stone trim	806.0	Cu. ft.	0.88	709.28	1.03	830.18	1.04	838.24	1.04	838.24	1.19	959.14
Miscellaneous iron	35.8	Cwt.	1.92	68.74	1.98	70.88	2.11	75.54	1.70	60.86	1.76	63.01
Slate roofing	73.0	Sqr.	5.27	384.71	5.28	385.44	5.49	400.77	5.43	396.39	5.35	390.55
Simple framing—wood	45.4	M.B.M.	23.13	1,050.10	29.13	1,322.50	29.44	1,336.58	26.59	1,207.19	25.23	1,145.44
Interior sheathing	9.5	M.B.M.	26.21	249.00	31.54	299.63	32.18	305.71	32.25	306.38	31.99	303.91
Finish flooring	6.1	M.B.M.	33.63	205.14	40.47	246.87	41.29	251.87	41.37	252.36	41.05	250.41
Nails	25.2	Kegs	1.90	47.88	1.96	49.39	2.12	53.42	2.10	52.92	1.92	48.38
Windows	841.0	Sq. ft.	0.31	260.71	0.31	260.71	0.33	277.53	0.31	260.71	0.31	260.71
Doors	561.0	Sq. ft.	0.36	201.96	0.35	196.35	0.37	207.57	0.36	201.96	0.36	201.96
Wood mouldings—less than 5 in.	51.3	C.L.F.	1.29	66.18	1.21	62.07	1.32	67.72	1.27	65.15	1.29	66.18
Wood mouldings 5 in. and over	2.2	C.L.F.	3.19	7.02	3.00	6.60	3.27	7.19	3.14	6.91	3.20	7.04
Hemlock undersheathing	13.8	M.B.M.	21.15	291.87	26.63	367.49	26.92	371.50	24.31	335.48	23.07	318.37
Wood lath	8.9	M.	3.54	31.51	4.45	39.60	4.50	40.05	4.06	36.13	3.86	34.35
Y.P. trim	0.1	M.B.M.	26.21	2.62	31.54	3.15	32.18	3.22	32.25	3.23	31.99	3.20
Building paper	21.4	Rolls	0.57	12.20	0.56	11.98	0.57	12.20	0.57	12.20	0.55	11.77
Concrete forms	5.4	M.B.M.	23.13	124.90	29.13	157.30	29.44	158.98	26.59	143.59	25.23	136.24
Tile flooring	350.0	Sq. ft.	0.42	147.00	0.40	140.00	0.39	136.50	0.39	136.50	0.42	147.00
16 oz. copper flashing	9.9	Sqr.	20.40	201.96	24.31	240.67	28.41	231.26	18.42	182.36	18.43	182.46
16 oz. copper leaders	1.2	C.L.F.	32.23	38.68	38.12	45.74	44.27	53.12	29.33	35.20	29.39	35.27
Skylights—copper	30.0	Sq. ft.	0.460	13.80	0.501	15.03	0.544	16.32	0.400	12.00	0.426	12.78
Paint—lead and oil	60.8	Gal.	1.14	69.31	1.18	71.74	1.20	72.96	1.14	69.31	1.22	74.18
Paint—varnish	41.5	Gal.	1.05	43.58	1.10	45.65	1.05	43.58	0.78	32.37	0.87	36.11
Total cost of material				$6,044.59		$ 6,787.96		$ 6,810.81		$ 6,352.85		$ 6,500.75
Laborer (excavating)	2,925.0	Hr.	0.2008	587.34	0.2146	627.70	0.2224	650.52	0.2469	722.18	0.2469	722.18
Laborer (building)	2,029.0	Hr.	0.1931	391.80	0.2028	411.48	0.2255	457.54	0.2276	461.80	0.2391	485.13
Hod carrier	1,242.0	Hr.	0.2957	367.26	0.3045	378.19	0.3159	392.35	0.3188	395.95	0.3227	400.79
Brick layer	1,232.0	Hr.	0.5938	731.56	0.6037	743.76	0.6069	747.70	0.6121	754.11	0.6157	758.54
Carpenter	2,123.0	Hr.	0.4255	905.46	0.4412	936.67	0.4647	986.56	0.4656	988.47	0.4765	1,011.61
Slate roofer	212	Hr.	0.3861	81.85	0.3972	84.21	0.4018	85.18	0.4282	90.78	0.4545	96.35
Sheet metal worker	49	Hr.	0.4179	20.48	0.4250	20.82	0.4241	20.78	0.4343	21.28	0.4450	21.81
Painter	618	Hr.	0.3879	239.72	0.3979	245.90	0.4145	256.16	0.4195	259.25	0.4248	262.53
Plasterer	129	Hr.	0.5653	72.92	0.5860	75.59	0.6028	77.76	0.5938	76.60	0.6055	78.11
Tile setter	39	Hr.	0.5297	20.66	0.5312	20.72	0.5466	21.32	0.5479	21.37	0.5533	21.58
Cement mason	22	Hr.	0.4757	10.46	0.4899	10.78	0.5496	12.09	0.5514	12.13	0.5548	12.21
Lather—wood	49	Hr.	0.4492	22.01	0.4353	21.32	0.4397	21.55	0.4701	23.03	0.4923	24.12
Total cost of labor				$3,451.52		$ 3,577.14		$ 3,729.51		$ 3,826.95		$ 3,894.96
Grand total				$9,496.11		$10,365.10		$10,540.32		$10,179.80		$10,395.71
Per cent of 1914 cost				86.30		94.20		95.79		92.51		94.48

ESTIMATED AVERAGE COST OF A TYPICAL BRICK PASSENGER STATION.—(*Continued*)

Item	Quantity	Unit	1910		1911		1912		1913		1914	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	330.5	Bbl.	$ 1.26	$ 416.43	$ 1.20	$ 396.60	$ 1.06	$ 350.33	$ 1.32	$ 436.26	$ 1.32	$ 436.26
Lime (300 lb.)	47.8	Bbl.	1.08	51.62	1.15	54.97	1.13	54.01	1.12	53.54	1.07	51.15
Sand	154.2	Cu. yd.	1.16	178.87	1.16	178.87	1.22	188.12	1.24	191.21	1.25	192.75
Crushed stone	176.7	Cu. yd.	1.16	204.97	1.16	204.97	1.22	215.57	1.24	219.10	1.25	220.88
Cinders	16.7	Cu. yd.	0.47	7.85	0.47	7.85	0.48	8.02	0.48	8.02	0.48	8.02
Brick—common	65.3	M. brk.	6.51	425.10	6.70	437.51	7.60	496.28	7.64	498.89	7.05	460.37
Brick—face	22.8	M. brk.	22.15	505.02	19.94	454.63	24.66	562.25	24.68	562.70	21.73	495.44
Stone trim	806.0	Cu. ft.	1.19	959.14	1.19	959.14	1.19	959.14	1.19	959.14	1.20	967.20
Miscellaneous iron	35.8	Cwt.	1.85	66.23	1.64	58.71	1.75	62.65	1.92	68.74	1.59	56.92
Slate roofing	73.0	Sqr.	5.33	389.09	5.28	385.44	5.23	381.79	5.59	408.07	5.78	421.94
Simple framing—wood	45.4	M.B.M.	25.67	1,165.42	26.20	1,189.48	27.16	1,233.06	28.03	1,272.56	26.17	1,188.12
Interior sheathing	9.5	M.B.M.	31.80	302.10	31.12	295.64	31.73	301.44	33.92	322.24	32.12	305.14
Finish flooring	6.1	M.B.M.	40.80	248.88	39.93	243.57	40.72	248.39	43.52	265.47	41.21	251.38
Nails	25.2	Kegs	1.89	47.63	1.80	45.36	1.74	43.85	1.82	45.86	1.68	42.34
Windows	841.0	Sq. ft.	0.31	260.71	0.28	235.48	0.27	227.07	0.29	243.89	0.29	243.89
Doors	561.0	Sq. ft.	0.36	201.96	0.31	173.91	0.30	168.30	0.31	173.91	0.31	173.91
Wood mouldings less than 5 in.	51.3	C.L.F.	1.22	62.59	1.17	60.02	1.10	56.43	1.14	58.48	1.13	57.97
Wood mouldings 5 in. and over	2.2	C.L.F.	3.02	6.64	2.89	6.36	2.73	6.01	2.84	6.25	2.80	6.16
Hemlock undersheathing	13.8	M.B.M.	23.48	324.02	23.95	330.51	24.84	342.79	25.63	353.69	23.93	330.23
Wood lath	8.9	M.	3.92	34.89	4.00	35.60	4.15	36.94	4.28	38.09	4.00	35.60
Y.P. trim	0.1	M.B.M.	31.80	3.18	31.12	3.11	31.73	3.17	33.92	3.39	32.12	3.21
Building paper	21.4	Rolls	0.52	11.13	0.52	11.13	0.52	11.13	0.52	11.13	0.52	11.13
Concrete forms	5.4	M.B.M	25.67	138.62	26.20	141.48	27.16	146.66	28.03	151.36	26.17	141.32
Tile flooring	350.0	Sq. ft.	0.41	143.50	0.38	133.00	0.45	157.50	0.45	157.50	0.40	140.00
16 oz. copper flashing	9.9	Sqr.	18.56	183.74	17.16	169.88	21.88	216.61	21.81	215.92	19.43	192.35
16 oz. copper leaders	1.2	C.L.F.	29.64	35.57	27.56	33.07	34.69	41.63	34.68	41.62	31.20	37.44
Skylights—copper	30.0	Sq. ft.	0.467	14.01	0.435	13.05	0.478	14.34	0.498	14.94	0.457	13.71
Paint—lead and oil	60.8	Gal.	1.45	88.16	1.50	91.20	1.33	80.86	1.20	72.96	1.23	74.78
Paint—varnish	41.5	Gal.	1.22	50.63	1.23	51.05	0.87	36.11	0.76	31.54	0.83	34.45
Total cost of material				$ 6,527.70		$ 6,401.59		$ 6,650.45		$ 6,886.47		$ 6,594.06
Laborer (excavating)	2,925.0	Hr.	0.2594	758.75	0.2594	758.75	0.2750	804.38	0.2800	819.00	0.2829	827.48
Laborer (building)	2,029.0	Hr.	0.2439	494.87	0.2476	502.38	0.2591	525.71	0.2633	534.24	0.2798	567.71
Hod carrier	1,242.0	Hr.	0.3323	412.72	0.3363	417.68	0.3404	422.78	0.3451	428.61	0.3505	435.32
Brick layer	1,232.0	Hr.	0.6286	774.44	0.6286	774.44	0.6857	783.18	0.6589	811.76	0.6744	830.86
Carpenter	2,123.0	Hr.	0.4951	1,051.10	0.5000	1,061.50	0.5094	1,081.46	0.5223	1,108.84	0.5376	1,141.32
Slate roofer	212.0	Hr.	0.4540	96.25	0.4696	99.56	0.4830	102.40	0.5089	107.89	0.5612	118.97
Sheet metal worker	49.0	Hr.	0.4625	22.66	0.4670	22.88	0.4810	23.57	0.5060	24.79	0.5267	25.81
Painter	618.0	Hr.	0.4419	273.09	0.4575	282.74	0.4685	289.53	0.4862	300.47	0.5019	310.17
Plasterer	129.0	Hr.	0.6223	80.28	0.6268	80.86	0.6313	81.44	0.6500	83.85	0.6590	85.01
Tile setter	39.0	Hr.	0.5657	22.06	0.5668	22.11	0.5804	22.64	0.5996	23.38	0.6114	23.85
Cement mason	22.0	Hr.	0.5645	12.42	0.5663	12.46	0.5698	12.54	0.5920	13.02	0.6200	13.64
Lather—wood	49.0	Hr.	0.5114	25.06	0.5305	25.99	0.5509	26.99	0.5760	28.22	0.5966	29.23
Total cost of labor				$ 4,023.70		$ 4,061.35		$ 4,176.62		$ 4,284.07		$ 4,409.37
Grand total				$10,551.40		$10,462.94		$10,827.07		$11,170.54		$11,003.43
Per cent of 1914 cost				95.89		95.09		98.40		101.52		100.00
Reciprocal				1.043		1.052		1.016		0.985		1.000

ESTIMATED AVERAGE COST OF A TYPICAL BRICK PASSENGER STATION.—(*Continued*)

Item	Quantity	Unit	1915		1916		1917		1918		1919	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	339 5	Bbl.	$ 1 10	$ 393 30	$ 1 44	$ 475 92	$ 1 85	$ 611 43	$ 2 27	$ 749 24	$ 2 73	$ 902 27
Lime (300 lb.)	47 8	Bbl.	1 28	61 12	1 45	69 31	1 82	87 00	2 38	113 76	2 76	131 93
Sand	154 2	Cu. yd.	1 27	195 83	1 35	208 17	1 56	240 55	1 87	288 35	2 01	309 94
Crushed stone	176 7	Cu. yd.	1 27	224 41	1 35	238 55	1 56	275 65	1 87	330 43	2 01	355 17
Cinders	16 7	Cu. yd.	0 50	8 35	0 51	8 52	0 55	9 19	0 69	11 52	0 75	12 53
Brick—common	65 3	M. brk.	7 05	460 37	8 41	549 17	9 83	641 90	13 95	910 94	16 23	1,059 82
Brick—face	22 8	M. brk.	22 32	508 90	23 52	536 26	23 97	546 52	29 39	670 09	34 65	789 56
Stone trim	306 0	Cu. ft.	1 20	367 20	1 30	1,047 60	1 31	1,055 86	1.53	1,971 93	1 74	1,402 44
Miscellaneous iron	35 8	Cwt.	1 74	62 29	3 27	117 07	4 58	163 96	4 55	162 89	3 74	133 89
Slate roofing	73 0	Sqr.	5 59	461 50	5 69	415 37	6 73	491 29	8 12	592 76	8 96	654 08
Simple framing—wood	45 4	M.B.M.	24 97	1,133 64	29 47	1,137 94	36 52	1,658 46	44 91	2,038 91	54 64	2,480 06
Interior sheathing	9 5	M.B.M.	30 03	285 29	32 57	309 42	38 97	367 37	37 47	355 97	55 25	524 88
Finish flooring	6 1	M.B.M.	38 53	235 03	41 79	254 92	49 62	302 68	46 99	286 25	70 22	422 37
Nails	25 2	Kegs	1 75	44 10	2 60	65 52	2 62	91 42	2 60	90 72	3 52	88 70
Windows	841.0	Sq. ft.	0 29	243 89	0 32	269 12	0 39	327 99	0 51	428 91	0 63	529 83
Doors	561 0	Sq. ft.	0 32	179 52	0 36	201 96	0 44	246 84	0 55	308 55	0 69	387 09
Wood mouldings less than 5 in.	51.3	C.L.F.	1 11	56 94	1 13	57 97	1.27	65 15	1 64	84 13	2 24	114 91
Wood mouldings 5 in. and over	2.2	C.L.F.	2 74	6 03	2 80	6 16	3.15	6 93	4 07	8 95	5 55	12 21
Hemlock undersheathing	13 8	M.B.M	22 83	315 05	26 95	371 91	33.41	461 06	41 06	566 63	49 97	689 59
Wood lath	8 9	M.	3 82	34 00	4 50	40 05	5.58	49 66	6 86	61 05	8 35	74 32
Y.P. trim	0 1	M.B.M.	30 03	3 00	32 57	3 26	38 97	3 87	37 47	3 75	55 25	5 53
Building paper	21 4	Rolls	0 52	11 13	0 70	14 98	0 79	16 91	0 92	19 69	0 96	20 54
Concrete forms	5 4	M.B.M.	24 97	134 84	29 47	159 14	36 53	197 26	44 91	242 51	54 64	295 06
Tile flooring	350 0	Sq. ft.	0 41	143 50	0 43	150 50	0 44	154 00	0 54	189 00	0 64	224 00
16 oz. copper flashing	9 5	Sqr.	23 14	219 99	26 55	261 85	29 78	293 82	24 58	242 24	29 40	291 06
16 oz. copper leaders	1 2	C.L.F.	36 81	44 17	56 94	68 33	61.88	74 26	54.40	65 28	47.01	56 41
Skylights—copper	30 0	Sq. ft.	0 477	14 31	0 696	20 88	0.771	23.13	0.750	22 50	0.797	23 91
Paint—lead and oil	60 8	Gal.	1 29	78 43	1 68	102.14	2.12	128 90	2.61	158 69	2.82	171.46
Paint—varnish	41 5	Gal.	0 82	34 03	0 92	38.18	1.00	41.50	1.28	53 12	2.25	93 38
Total cost of material				$ 6,509 32		$ 7,390 37		$ 8,734 62		$10,237 01		$12,267 54
Laborer (excavating)	2,925 0	Hr.	0 2864	837 72	0 3042	890 02	0 3500	1,023 75	0 4210	1,231 42	0 4517	1,321 22
Laborer (building)	2,029 0	Hr.	0 2760	560 00	0 3124	633 86	0 3607	731 86	0 4656	945 31	0 5891	1,993 53
Hod carrier	1,242 0	Hr.	0 3517	436 81	0 3723	462 40	0 4206	522 39	0 5006	621 75	0 6007	746 07
Brick layer	1,232 0	Hr.	0 6834	841 95	0 6911	851 44	0 7357	906 32	0 7932	977 06	0 9096	1,113 24
Carpenter	2,123 0	Hr.	0 5491	1,165 74	0 5653	1,200 13	0 6212	1,319 02	0 6784	1,440 24	0 7782	1,652 97
Slate roofer	212 0	Hr.	0 5706	120 97	0 5809	123 15	0 6188	131 19	0 6705	142 15	0 7615	161 44
Sheet metal worker	49 0	Hr.	0 5362	26 27	0 5424	26 58	0 5661	27 74	0 5492	31 81	0 7471	36 61
Painter	618 0	Hr.	0 5028	310 73	0 5325	329 09	0 5647	347 12	0 6466	399 54	0 7492	457.44
Plasterer	129 0	Hr.	0 6693	86 34	0 6831	88.12	0.7134	92.03	0.5470	70.58	0.8579	111 96
Tile setter	39 0	Hr.	0 6203	24 19	0 6395	24 94	0.6636	25 88	0.6834	26.67	0.7407	28 89
Cement mason	22 0	Hr.	0 6299	13 86	0 6357	13 99	0 6714	14 77	0 7200	15 93	0 8232	18 11
Lather—wood	49 0	Hr.	0 5846	28 65	0 6006	29 37	0 6595	32 32	0 7126	34 92	0 7805	38 24
Total cost of labor				$ 4 453 32		$ 4,673 65		$ 5,174 48		$ 5,938 37		$ 6,780 02
Grand total				$10,962 55		$11 974 02		$13 909 09		$16,175 38		$19,047 56
Per cent of 1914 cost				99 63		108 82		126 41		147 09		173 10
Reproval												

COST AND PER CENT OF 1914 COST OF BRICK PASSENGER STATION INCLUDING PLUMBING, HEATING AND LIGHTING

Year	Cost of building	Plumbing		Heating		Lighting		Total cost of building including plumbing, heating, and lighting	Per cent of 1914 cost	Reciprocal
		Per cent of 1914 cost	Cost	Per cent of 1914 cost	Cost	Per cent of 1914 cost	Cost			
1890	$ 8,298.47	$ 93 65	$ 626.52	$ 93.10	$1,268.02	$100.54	$305.64	$10,498.65	$ 78.71	1.270
1891	8,054.27	93.65	626.52	87.30	1,189.03	100.54	305.64	10,175.46	76.29	1.311
1892	7,893.17	93.65	626.52	83 48	1,137.00	100 54	305.64	9,962.33	74.69	1.339
1893	7,984.84	93 65	626.52	80.00	1,089.60	100.54	305.64	10,006.60	75 02	1.333
1894	7,581.16	93.65	626.52	72 76	990.99	100.54	305.64	9,504.31	71.25	1.404
1895	7,313 79	93.65	626 52	76 21	1,037.98	100.54	305.64	9,283.93	69.60	1.437
1896	7,387.25	93 65	626.52	76 19	1,037.71	100 54	305.64	9,357.12	70.15	1.426
1897	7,280.08	93.65	626.52	70.37	958.44	100.54	305.64	9,170.68	68.75	1.455
1898	7,503.70	93.65	626.52	70 46	959.67	100.54	305.64	9,395.53	70.44	1.420
1899	8,191.09	93.65	626 52	91.50	1,246.23	100.54	305.64	10,369.48	77.74	1.286
1900	8,707.28	93 65	626 52	90.40	1,231.25	100 54	305 64	10,870.69	81.50	1.227
1901	8,740 74	92 47	618 62	93.15	1,268 70	100.54	305 64	10,933 70	81.97	1.220
1902	9,062.85	93.44	625.11	102.45	1,395 37	100.54	305.64	11,388.97	85.38	1.171
1903	9,328.38	96.45	645 25	101.40	1,381.07	100.54	305.64	11,660.34	87 42	1.144
1904	9,235.51	95 51	638 96	92.52	1,260.12	100.54	305.64	11,440.23	85.77	1.166
1905	9,496.11	97 33	651.14	98.99	1,348.24	98 51	299 47	11,794.96	88.43	1.131
1906	10,365.10	99.89	668.26	107.90	1,469.60	111 75	339 72	12,842.68	96.28	1.039
1907	10,540.32	104.67	700 24	114 68	1,261.94	112.08	340.72	12,843.22	96 29	1.039
1908	10,179.80	100.05	669.33	108.21	1,473.82	111.45	338.81	12,661.76	94.93	1.053
1909	10,395 71	96 96	648.66	99 66	1,357.37	104.74	318.56	12,720.30	95 36	1.049
1910	10,551.40	100.76	674 08	98.58	1,342.66	107 84	327.83	12,895.97	96.68	1.034
1911	10,462 94	98 29	657.56	96.62	1,315.96	102.11	310.41	12,746.87	95 56	1.046
1912	10,827.07	100.03	669 20	100.70	1,371 53	102.77	312.42	13,180.22	98.81	1.012
1913	11,170.54	101.70	680.37	104.25	1,419.89	104.64	318.11	13,588.91	101.88	0.982
1914	11,003.43	100 00	669 00	100 00	1,362 00	100.00	304.00	13,338.43	100 00	1.000
1915	10,962.55	103 05	689 40	102.23	1,392 37	105 16	319.69	13,364.01	100.19	0.998
1916	11,974.02	110.50	739.25	129 44	1,762 97	115.20	350.21	14,826.45	111.15	0.900
1917	13,909.08	125 56	840.00	174.08	2,370.97	137.18	417.03	17,537 08	131.48	0.761
1918	16,175.38	128 00	856.32	202.05	2,751 92	156 81	476.70	20,260 32	151.89	0.658
1919	19,047.56	135.31	905.22	180 57	2,459.36	196 18	602 47	23,014.61	172.54	0.580
1920	25,132.87	190.38	1,273 64	217.91	2,967 93	188 27	572 34	29,946 78	224.51	0.445
1921	22,035.31	213.00	1,424.97	185 78	2,530.32	159.80	485.79	26,476 39	198.43	0.504
1922	20,280.26	205.32	1,373 59	168 03	2,288 57	136 53	415 05	24,357 47	182 61	0.548
1923	22,936.52	224.48	1,501.77	198.92	2,709.29	155.26	471.99	27,619 57	207.06	0.483

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS

	Item	Quantity	Unit	1900		1901		1902		1903	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
1	Brick, common	1,526.223	M. brk.	$ 5.80	$ 8,852.09	$ 6 34	$ 9,676.25	$ 5.99	$ 9,142.08	$ 6 53	$ 9,966.24
2	Brick, face	120.410	M. brk.	20.95	2,522.59	20.99	2,527.41	21 43	2,580.39	22 69	2,732.10
3	Lumber, rough	219.310	M.B.M.	20.46	4,487.08	17.97	3,941.00	19.00	4,166 89	19.84	4,351.11
4	Floors, hemlock	46.865	M.B.M.	22.58	1,058 21	19.72	924.18	20 87	978.07	21.71	1,017.44
5	Floors, maple	54 045	M.B.M.	27.94	1,510 02	31.48	1,701.34	32 39	1,750.52	32.35	1,748 36
6	Sleepers, spruce	20.890	M.B.M.	22.38	467 52	19 65	410 49	20.78	434.09	21.69	453.10
7	Trim quartered oak D4S	7.449	M.B.M.	41.00	305.41	38 00	283 06	42 00	312.86	45 00	335.21
8	Moldings quartered oak	17,742 0	Lin. ft.	0 0135	239.52	0.0153	271.45	0.0170	301.61	0.0146	259.03
9	Grounds	2.314	M.B.M.	22 58	52 25	19.72	45.63	20.87	48.29	21.71	50.24
10	Cement	5,627 0	Bbl.	1 89	10,635.03	1.62	9,115.74	1.68	9,453.36	1.76	9,903.52
11	Cinder	287.0	Cu. yd.	0.41	117 67	0 43	123 41	0.43	123.41	0.44	126.28
12	Hardware, rough	12,443.0	Lb.	0.0263	327 25	0.0237	294.90	0.0210	261.30	0.0208	258.81
13	Mesh reinforcement	60,190.0	Lb.	0.0514	3,093.77	0.0458	2,756.70	0.0445	2,678.46	0.0413	2,485.85
14	Lime	806.0	Bbl.	0.71	572.26	0.80	644.80	0.84	677 04	0 82	660 92
15	Paint	1,467.0	Gal.	1.21	1,775 07	1 15	1,687 05	1.09	1,599 03	1.09	1,599.03
16	Sand and gravel	3,616.0	Cu. yd.	0.82	2,965.12	0.85	3,073.60	0.88	3,182 08	0.88	3,182.08
17	Doors, kalamein	357 0	Sq. ft.	0.466	166.36	0.464	165.65	0.502	179.21	0.516	184.21
18	Doors, copper covered	42 0	Sq. ft.	1.01	42 42	1 02	42.84	0.97	40.74	1.03	43.26
19	Doors, self closing, tin covered	60 0	Sq. ft.	0.466	27 96	0.464	27.84	0.502	30.12	0.516	30.96
20	Metal furring	184.41	Cwt.	3.32	612.24	2.80	516.35	3.24	597.49	2.93	540.32
21	Cast iron drain 6 in	5,920 0	Lb.	0.0122	72 22	0 0115	68.08	0.0139	82 29	0.0144	85.25
22	Varnish	76.0	Gal.	0.85	64.60	0.70	53.20	0.84	63.84	0.95	72.20
23	Hair	321.0	Bu.	0.204	65.48	0.168	53.93	0.208	66.77	0.176	56.50
24	Fiber	160.0	Bu.	0.255	40.80	0.210	33.60	0.260	41.60	0.220	35.20
25	Prepared plaster	34,709.0	Lb.	0.0017	59.01	0.0019	65.95	0.0020	69.42	0.0019	65.95
26	Metal lath	5,238.0	Sq. yd.	0.23	1,204.74	0.24	1,257.12	0.22	1,152.36	0.20	1,047.60
27	Corner bead	7,101 0	Lin. ft.	0.056	397 66	0 060	426.06	0.056	397.66	0.050	355.05
28	Cold water paint	890.0	Lb.	0.0124	11 04	0.0141	12.55	0.0146	12.99	0.0142	12.64
29	Filler, paste	249 0	Lb.	0.056	13.94	0.046	11.45	0.056	13.94	0.063	15.69
30	Turpentine	256 0	Gal.	0.477	122.11	0.373	95.49	0.474	121.34	0.572	146.43
31	Hollow tile	598.99	Tons	7.00	4,192 93	7.15	4,282 78	7.15	4,282 78	7.25	4,342.68
32	Door 1¾ in. quartered oak	3,149.0	Sq. ft.	0.748	2,355 45	0 856	2,695.54	0.958	3,016.74	0.817	2,572.73
33	Sash 1¾ in. quartered oak	2,702.0	Sq. ft.	0.321	867 34	0.409	1,105.12	0.405	1,094.31	0.340	918.68
34	Sash 1¾ in. white pine	6,999 0	Sq. ft.	0.321	2,246 68	0 409	2,862.59	0.405	2,834.60	0.340	2,379.66
35	Structural steel, fabricated and erected	16,305.66	Cwt.	3.32	54,134.79	2.80	45,655.85	3.24	52,830.34	2.93	47,775.58
	Total				$105,678.63		$ 96,909.00		$104,618.02		$99,809.91

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1904		1905		1906		1907	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
1	Brick, common	1,526.223	M. brk.	$ 8.13	$12,408.19	$ 8.73	$13,323.93	$ 9.21	$ 14,056.51	$ 6.89	$ 10,515.68
2	Brick, face	120.410	M. brk.	23.31	2,806.76	22.69	2,732.10	21.62	2,603.26	21.24	2,557 51
3	Lumber, rough	219.310	M.B.M.	20.13	4,414.71	21.15	4,638.41	26.63	5,840.23	26.92	5,903 83
4	Floors, hemlock	46.865	M.B.M.	22 04	1,032.90	23.16	1,085.39	29.33	1,374.55	29 63	1,388.61
5	Floors, maple	54.045	M.B.M.	32 35	1,748 36	33.63	1,817.53	40.47	2,187.20	41.29	2,231 52
6	Sleepers, spruce	20.890	M.B.M.	22.01	459.79	23.13	483 19	29 13	608 53	29.44	615 00
7	Trim quartered oak D4S	7 449	M.B.M.	46.00	342 65	48.00	375.55	50 00	372.45	55.00	409 70
8	Moldings quartered oak	17,742 0	Lin. ft.	0 0139	246 61	0 0146	259 03	0 0138	244 84	0 0146	259 03
9	Grounds	2.314	M.B.M.	22.04	51.00	23.16	53.59	29.33	67.87	29.63	68.56
10	Cement	5,627.0	Bbl.	1.19	6,696 13	1 16	6,527 32	1.38	7,765.26	1.46	8,215.42
11	Cinder	287.0	Cu. yd.	0.44	126.28	0.43	123.41	0.44	126.28	0.44	126.28
12	Hardware, rough	12,443.0	Lb.	0.0191	237.66	0.0190	236.42	0.0196	243.88	0.0212	263.79
13	Mesh reinforcement	60,190.0	Lb.	0.0380	2,287 22	0 0361	2,172 86	0 0367	2,208.97	0.0397	2,389 54
14	Lime	806.0	Bbl.	0.86	693.16	0.92	741.52	0.98	789.88	0.99	797.94
15	Paint	1,467.0	Gal.	1.06	1,555.02	1.14	1,672.38	1.18	1,731.06	1.20	1,760.40
16	Sand and gravel	3,616.0	Cu. yd.	0.89	3,218.24	0.89	3,218.24	0.95	3,435.20	0.99	3,579.84
17	Doors, kalamein	357.0	Sq. ft.	0.515	183.86	0.559	199.56	0.608	217.06	0.623	222.41
18	Doors, copper covered	42.0	Sq. ft.	1.00	42.00	1.10	46.20	1.26	52.92	1.39	58.38
19	Doors, self closing, tin covered	60.0	Sq. ft.	0.515	30.90	0.559	33.54	0.608	36.48	0.623	37.38
20	Metal furring	184.41	Cwt.	2.72	501.60	2.87	529.26	3.00	553.23	3.01	555 07
21	Cast iron drain 6 in	5,920.0	Lb.	0.0121	71.63	0.0139	82.29	0.0157	92.94	0.0164	97.09
22	Varnish	76.0	Gal.	0.96	72.96	1.05	79.80	1.10	83.60	1.05	79.80
23	Hair	321.0	Bu.	0.180	57.78	0.184	59.06	0.192	61.63	0.196	62.92
24	Fiber	160.0	Bu.	0.225	36.00	0.230	36.80	0.240	38.40	0.245	39.20
25	Prepared plaster	34,709.0	Lb.	0.0020	69.42	0.0022	76.36	0.0023	79.83	0.0023	79.83
26	Metal lath	5,238.0	Sq. yd.	0.16	838.08	0.17	890.46	0.18	942.84	0.19	995.22
27	Corner bead	7,101.0	Lin. ft.	0.041	291.14	0.043	305.34	0.046	326.65	0.048	340.85
28	Cold water paint	890.0	Lb.	0.0150	13.35	0.0161	14.33	0.0172	15.31	0.0172	15.31
29	Filler, paste	249.0	Lb.	0.064	15.94	0.070	17.43	0.073	18 18	0.070	17.43
30	Turpentine	256.0	Gal.	0.576	147.46	0.628	160.77	0.665	170.24	0.634	162.30
31	Hollow tile	598.99	Tons	7.30	4,372.63	7.05	4,222.88	6.90	4,133.03	7.05	4,222.88
32	Door 1¾ in. quartered oak	3,149.0	Sq. ft	0.815	2,566.44	0 906	2,852 99	0.902	2,840.40	0.950	2,991 55
33	Sash 1¾ in. quartered oak	2,702.0	Sq. ft.	0.347	937 59	0 362	978 12	0.361	975.42	0 375	1,013 25
34	Sash 1¾ in. white pine	6,999.0	Sq. ft.	0.347	2,428.65	0.362	2,533 64	0 361	2,526.64	0 375	2,624 63
35	Structural steel, fabricated and erected	16,305.66	Cwt.	2.72	44,351.40	2.87	46,797.24	3.00	48,916.98	3.01	49,080.04
	Total				$95,353.51		$99,358 94		$105,737.75		$103,768.19

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1903		1909		1910		1911	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
1	Brick, common	1,526.223	M. brk.	$ 5 84	$ 8,913.14	$ 7.16	$10,927.76	$ 6.51	$ 9,935.71	$ 6.70	$10,225 69
2	Brick, face	120.410	M. brk.	21 25	2,558.71	22.73	2,736 92	22 15	2,667 08	19 94	2,400 98
3	Lumber, rough	219.310	M.B.M.	24.31	5,331.43	23 07	5,059 48	23 48	5,149 40	23.95	5,252 47
4	Floors, hemlock	46.865	M.B.M.	26 49	1,241.45	24 92	1,167.88	25 42	1,191 31	26 02	1,219.43
5	Floor, maple	54 045	M.B.M.	41 37	2,235 84	41 05	2,218 55	40.80	2,205 04	39 93	2,158.02
6	Sleepers, spruce	20.890	M.B.M.	26 59	555 47	25 23	527 05	25 67	536.25	26.20	547 32
7	Trim quartered oak D4S	7.449	M.B.M.	50 00	372.45	49 00	365 00	54 00	402.25	55.00	409 70
8	Moldings quartered oak	17,742 0	Lin. ft.	0 0133	235 97	0.0132	234 19	0 0133	235.97	0.0127	225.32
9	Grounds	2.314	M.B.M.	26.49	61 30	24.92	57 66	25.42	58 82	26.02	60.21
10	Cement	5,627 0	Bbl.	1.27	7,146 29	1 23	6,921 21	1 26	7,090.02	1.20	6,752.40
11	Cinder	287 0	Cu. yd.	0.45	129.15	0.46	132 02	0 47	134.89	0.47	134 89
12	Hardware, rough	12,443.0	Lb.	0.0210	261 30	0.0192	238 91	0 0189	235.17	0.0180	223 97
13	Mesh reinforcement	60,190 0	Lb.	0.0397	2,389.54	0.0358	2,154 80	0.0322	1,938.12	0.0328	1,974.23
14	Lime	806.0	Bbl.	1.08	870 48	1.08	870.48	1.08	870.48	1.15	926 90
15	Paint	1.467 0	Gal.	1.14	1,672 38	1.22	1,789 74	1 45	2,127.15	1.50	2,200.50
16	Sand and gravel	3,616.0	Cu. yd.	1 09	3,941 44	1 09	3,941 44	1 16	4,194.56	1.16	4,194 56
17	Doors, kalamein	357.0	Sq. ft.	0.610	217 77	0.595	212 42	0.615	219.56	0.569	203.13
18	Doors, copper covered	42 0	Sq. ft.	1 08	45.36	1.07	44 94	1.09	45 78	1.01	42 42
19	Doors, self closing, tin covered	60 0	Sq. ft.	0 610	36.60	0.595	35.70	0.615	36.90	0 569	34 14
20	Metal furring	184 41	Cwt.	2.95	544.01	2.56	472 09	2.63	485 00	2.44	449 96
21	Cast iron drain 6 in.	5,920 0	Lb.	0.0130	76.96	0.0127	75 18	0 0121	71.63	0.0106	62.75
22	Varnish	76 0	Gal.	0 78	59 28	0.87	66 12	1.22	92 72	1.23	93.48
23	Hair	321.0	Bu.	0.156	50 08	0.128	41 09	0 136	43 66	0.132	42.37
24	Fibre	160.0	Bu.	0.195	31.20	0.160	25.60	0 170	27 20	0.165	26 40
25	Prepared plaster	34,709 0	Lb.	0.0025	86 77	0.0025	86 77	0 0025	86 77	0.0027	93.71
26	Metal lath	5,238.0	Sq. yd.	0.19	995.22	0.17	890 46	0 17	890 46	0.15	785.70
27	Corner bead	7,101 0	Lin. ft.	0 047	333.75	0.043	305 34	0.043	305 34	0.038	269.84
28	Cold water paint	890 0	Lb.	0 0189	16 82	0 0189	16 82	0 0189	16 82	0.0200	17.80
29	Filler, paste	249.0	Lb.	0 052	12 95	0.058	14 44	0 081	20 17	0 082	20.42
30	Turpentine	256 0	Gal.	0.453	115.97	0.491	125 70	0.683	174 85	0.679	173.82
31	Hollow tile	598 99	Tons	6 55	3,923.38	6.90	4,133 03	7.10	4,252 83	7 05	4,222.88
32	Door $1^{3}/_{4}$ in. quartered oak	3,149 0	Sq. ft.	0 915	2,881 34	0.925	2,912 83	0.920	2,897.08	0.789	2,484.56
33	Sash $1^{3}/_{4}$ in. quartered oak	2,702.0	Sq. ft.	0 349	943 00	0 351	948.40	0 368	994 34	0.320	864 64
34	Sash $1^{3}/_{4}$ in. white pine	6,999.0	Sq. ft.	0 349	2,442 65	0.351	2,456 65	0.368	2,575 63	0.320	2,239.68
35	Structural steel, fabricated and erected	16,305.66	Cwt.	2.95	48,101.70	2.56	41,742 49	2.63	42,883.89	2.44	39,785.81
	Total				$98,832.15		$93,949.16		$95,092.85		$90,820.10

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1912		1913		1914		1915	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
1	Brick, common	1,526.223	M. brk.	$ 7.60	$11,599.29	$ 7.64	$11,660.34	$ 7.05	$10,759.87	$ 7.05	$10,759.87
2	Brick, face	120.410	M. brk.	24.66	2,969.31	24.68	2,971.72	21.73	2,616.51	22.32	2,687.55
3	Lumber, rough	219.310	M.B.M.	24.84	5,447.66	25.63	5,620.92	23.93	5,248.09	22.83	5,006.85
4	Floors, hemlock	46.865	M.B.M.	26.92	1,261.61	27.29	1,278.95	24.90	1,166.94	24.05	1,127.10
5	Floor, maple	54.045	M.B.M.	40.72	2,200.71	43.52	2,352.04	41.21	2,227.19	38.53	2,082.35
6	Sleepers, spruce	20.890	M.B.M.	27.16	567.37	28.03	585.55	26.17	546.69	24.97	521.62
7	Trim quartered oak D4S	7.449	M.B.M.	56.00	417.14	60.00	446.94	60.00	446.94	58.00	432.04
8	Moldings quartered oak	17,742.0	Lin. ft.	0.0121	214.68	0.0131	232.42	0.0130	230.65	0.0122	216.45
9	Grounds	2.314	M.B.M.	26.92	62.29	27.29	63.15	24.90	57.62	24.05	55.65
01	Cement	5,627.0	Bbl.	1.06	5,964.62	1.32	7,427.64	1.32	7,427.64	1.19	6,696.13
11	Cinder	287.0	Cu. yd.	0.48	137.76	0.48	137.76	0.48	137.76	0.50	143.50
12	Hardware, rough	12,443.0	Lb.	0.0174	216.51	0.0182	226.46	0.0168	209.04	0.0175	217.75
13	Mesh reinforcement	60,190.0	Lb.	0.0322	1,938.12	0.0348	2,094.61	0.0325	1,956.18	0.0348	2,094.61
14	Lime	806.0	Bbl.	1.13	910.78	1.12	902.72	1.07	862.42	1.28	1,031.68
15	Paint	1,467.0	Gal.	1.33	1,951.11	1.20	1,760.40	1.23	1,804.41	1.29	1,892.43
16	Sand and gravel	3,616.0	Cu. yd.	1.22	4,411.52	1.24	4,483.84	1.25	4,520.00	1.27	4,592.32
17	Doors, kalamein	357.0	Sq. ft.	0.584	208.49	0.604	215.63	0.599	213.84	0.616	219.91
18	Doors, copper covered	42.0	Sq. ft.	1.16	48.72	1.18	49.56	1.11	46.62	1.24	52.08
19	Doors, self closing, tin covered	60.0	Sq. ft.	0.584	35.04	0.604	36.24	0.599	35.94	0.616	36.96
20	Metal furring	184.41	Cwt.	2.44	449.96	2.68	494.22	2.19	403.86	2.53	466.56
21	Cast iron drain 6 in	5,920.0	Lb.	0.0112	66.30	0.0117	69.26	0.0105	62.16	0.0115	68.08
22	Varnish	76.0	Gal.	0.87	66.12	0.76	57.76	0.83	63.08	0.82	62.32
23	Hair	321.0	Bu.	0.156	50.08	0.224	71.90	0.188	60.35	0.204	65.48
24	Fiber	160.0	Bu.	0.195	31.20	0.280	44.80	0.235	37.60	0.255	40.80
25	Prepared plaster	34,709.0	Lb.	0.0027	93.71	0.0026	90.24	0.0025	86.77	0.0030	104.13
26	Metal lath	5,238.0	Sq. yd.	0.15	785.70	0.16	838.08	0.14	733.32	0.14	733.32
27	Corner bead	7,101.0	Lin. ft.	0.037	262.74	0.041	291.14	0.035	248.54	0.036	255.64
28	Cold water paint	890.0	Lb.	0.0196	17.44	0.0194	17.27	0.0185	16.47	0.0224	19.94
29	Filler, paste	249.0	Lb.	0.058	14.44	0.050	12.45	0.055	13.70	0.054	13.45
30	Turpentine	256.0	Gal.	0.470	120.32	0.428	109.57	0.473	121.09	0.459	117.50
31	Hollow tile	598.99	Tons	7.20	4,312.73	7.80	4,672.12	7.30	4,372.63	7.45	4,462.48
32	Door 1¾ in. quartered oak	3,149.0	Sq. ft.	0.770	2,424.73	0.793	2,497.16	0.785	2,471.97	0.807	2,541.24
33	Sash 1¾ in. quartered oak	2,702.0	Sq. ft.	0.311	840.32	0.337	910.57	0.335	905.17	0.349	943.00
34	Sash 1¾ in. white pine	6,999.0	Sq. ft.	0.311	2,176.69	0.337	2,358.66	0.335	2,344.67	0.349	2,442.65
35	Structural steel, fabricated and erected	16,305.66	Cwt.	2.44	39,785.81	2.68	43,699.17	2.48	40,438.04	2.53	41,253.32
	Total				$92,061.02		$98,781.26		$92,893.77		$93,456.76

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1916		1917		1918		1919	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
1	Brick, common	1,526.223	M. brk.	$ 8.41	$ 12,835.54	$ 9.83	$ 15,002.77	$13.95	$ 21,290.81	$16.23	$ 24,770.60
2	Brick, face	120.410	M. brk.	23.52	2,832 04	23.97	2,886.23	29.39	3,538.85	34.63	4,169.80
3	Lumber, rough	219.310	M.B.M.	26.95	5,910.40	33.41	7,327.15	41.06	9,004.87	49.97	10,958.92
4	Floors, hemlock	46.865	M.B.M.	29 08	1,362.83	36.63	1,716.66	45.64	2,138 92	54.13	2,536.80
5	Floors, maple	54.045	M.B.M.	41.79	2,258 54	49 62	2,681.71	48.09	2,599.02	70.88	3,830.71
6	Sleepers, spruce	20.890	M.B.M.	29.47	615 63	36 53	763.11	44.91	938.17	54.64	1,141.43
7	Trim quartered oak D4S	7.449	M.B.M.	61 00	454 39	66 00	491.63	76.00	566.12	130 00	968.37
8	Moldings quartered oak	17,742 0	Lin. ft.	0 0134	237 74	0 0149	264.36	0.0189	335.32	0.0375	665.33
9	Grounds	2.314	M.B.M.	29.08	67 29	36 63	84 76	45.64	105.61	54.13	125.26
10	Cement	5,627 0	Bbl.	1 44	8,102 88	1.85	10,409.95	2.27	12,773.29	2.73	15,361.71
11	Cinder	287 0	Cu. yd.	0 51	146 37	0.55	157.85	0.69	198.03	0.75	215.25
12	Hardware, rough	12,443.0	Lb.	0.0260	323.52	0 0363	451.68	0.0360	447.95	0.0352	437.99
13	Mesh reinforcement	60,190.0	Lb.	0.0572	3,442 87	0 0816	4,911.50	0.0770	4,634.63	0.0738	4,442.02
14	Lime	806.0	Bbl.	1.45	1,168 70	1.82	1,466.92	2.38	1,918.28	2.76	2,224.56
15	Paint	1,467.0	Gal.	1.68	2,464.56	2.12	3,110 04	2.61	3,828.87	2.82	4,136.94
16	Sand and gravel	3,616.0	Cu. yd.	1.35	4,881 60	1.56	5,640 96	1.87	6,761.92	2.01	7,268.16
17	Doors, kalamein	357 0	Sq. ft.	0.741	264 54	0 976	348.43	1.096	391 27	1.169	417.33
18	Doors, copper covered	42 0	Sq. ft.	1.73	72 66	2 16	90.72	1.98	83.16	1.91	80.22
19	Doors, self closing, tin covered	60 0	Sq. ft.	0.741	44 46	0 976	58 56	1.096	65 76	1.169	70.14
20	Metal furring	184 41	Cwt.	4 16	767.15	4.86	896 23	4.53	835 38	3.65	673.10
21	Cast iron drain	5,920 0	Lb.	0.0158	93 54	0 0277	163.98	0.0303	179 38	0.0286	169.31
22	Varnish	76 0	Gal.	0 92	69 92	1.00	76 00	1.28	97 28	2 25	171.00
23	Hair	321 0	Bu.	0.280	89 88	0.432	138 67	0.500	160.50	0.400	128.40
24	Fiber	160 0	Bu.	0.350	56 00	0.540	86 40	0.625	100 00	0.500	80.00
25	Prepared plaster	34,709 0	Lb.	0.0034	118.01	0.0043	149.25	0.0056	194 37	0.0065	225.61
26	Metal lath	5,238.0	Sq. yd.	0.23	1,204 74	0.48	2,514.24	0.37	1,938.06	0.33	1,728.54
27	Corner bead	7,101 0	Lin. ft.	0.057	404 76	0.119	845.02	0.093	660.39	0.083	589.38
28	Cold water paint	890 0	Lb.	0.0254	22 61	0.0318	28 30	0.0418	37 20	0.0483	42.99
29	Filler, paste	249 0	Lb.	0 061	15 19	0 066	16.43	0.085	21 17	0.149	37.10
30	Turpentine	256 0	Gal.	0.491	125 70	0.488	124 93	0.594	152.06	1.210	309.76
31	Hollow tile	598 99	Tons	8.65	5,181 26	9.35	5,600 56	15.20	9,104.65	14.30	8,565 56
32	Door $1\frac{3}{4}$ in. quartered oak	3,149.0	Sq. ft.	0 946	2,978 95	1.200	3,778.80	1.464	4,610 14	1 798	5,661.90
33	Sash $1\frac{3}{4}$ in. quartered oak	2,702 0	Sq. ft.	0 398	1,075 40	0.491	1,326.68	0.660	1,783.32	0.804	2,172.41
34	Sash $1\frac{3}{4}$ in. white pine	6,999 0	Sq. ft.	0 398	2,785 60	0.491	3,436.51	0.660	4,619.34	0.804	5,627.20
35	Structural steel, fabricated and erected	16,305 66	Cwt.	4 16	67,831.55	4.86	79,245.51	4.53	73,864.64	3.65	59,515.66
	Total				$130,306 82		$156,292.50		$169,978.73		$169.519.46

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1920		1921		1922		1923	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
1	Brick, common	1,526.223	M. brk.	$25.06	$ 38,247.15	$20.32	$ 31,012.85	$18.34	$ 27,990.93	$21.27	$ 32,462.76
2	Brick, face	120.410	M. brk.	39.12	4,710.44	41.49	4,995.81	40.11	4,829.65	38.97	4,692.38
3	Lumber, rough	219.310	M.B.M.	59.11	12,963.41	45.78	10,040.01	45.78	10,040.01	49.61	10,879.97
4	Floors, hemlock	46.865	M.B.M.	63.20	2,961.87	49.10	2,301.07	50.50	2,366.68	55.68	2,609.44
5	Floors, maple	54.045	M.B.M.	135.05	7,298.78	84.81	4,583.56	85.76	4,634.90	99.73	5,389.91
6	Sleepers, spruce	20.890	M.B.M.	64.64	1,350.33	50.06	1,045.75	50.06	1,045.75	54.25	1,133.28
7	Trim quartered oak D4S	7.449	M.B.M.	193.00	1,437.66	134.00	998.17	130.00	968.37	139.00	1,035.41
8	Moldings quartered oak	17,742.0	Lin. ft.	0.0493	874.68	0.0345	612.10	0.0292	518.07	0.0357	633.39
9	Grounds	2.314	M.B.M.	63.20	146.24	49.10	113.62	50.50	116.86	55.68	128.84
10	Cement	5,627.0	Bbl.	3.44	19,356.88	2.67	15,024.09	2.36	13,279.72	2.50	14,067.50
11	Cinder	287.0	Cu. yd.	0.98	281.26	0.98	281.26	0.87	249.69	0.90	258.30
12	Hardware, rough	12,443.0	Lb.	0.0420	522.61	0.0307	382.00	0.0250	311.08	0.0290	360.85
13	Mesh reinforcement	60,190.0	Lb.	0.0829	4,989.75	0.0650	3,912.35	0.0546	3,286.37	0.0653	3,930.41
14	Lime	806.0	Bbl.	3.78	3,046.68	3.92	3,159.52	3.94	3,175.64	4.01	3,232.06
15	Paint	1,467.0	Gal.	3.02	4,430.34	2.20	3,227.40	2.19	3,212.73	2.26	3,315.42
16	Sand and gravel	3,616.0	Cu. yd.	3.01	10,884.16	2.62	9,473.92	2.22	8,027.52	2.77	10,016.32
17	Doors, kalamein	357.0	Sq. ft.	1.619	577.98	1.276	455.53	1.192	425.54	1.365	487.31
18	Doors, copper covered	42.0	Sq. ft.	2.34	98.28	1.79	75.18	1.72	72.24	1.98	83.16
19	Doors, self closing, tin covered	60.0	Sq. ft.	1.619	97.14	1.276	76.56	1.192	71.52	1.192	71.52
20	Metal furring	184.41	Cwt.	4.07	750.55	3.08	567.98	3.10	571.67	3.81	702.60
21	Cast iron drain	5,920.0	Lb.	0.0370	219.04	0.0273	161.62	0.0230	136.16	0.0300	177.60
22	Varnish	76.0	Gal.	3.05	231.80	1.20	91.20	1.91	145.16	2.50	190.00
23	Hair	321.0	Bu.	0.384	123.26	0.276	88.60	0.268	86.03	0.276	88.60
24	Fiber	160.0	Bu.	0.480	76.80	0.345	55.20	0.335	53.60	0.345	55.20
25	Prepared plaster	34,709.0	Lb.	0.0088	305.44	0.0092	319.32	0.0092	319.32	0.0094	326.26
26	Metal lath	5,238.0	Sq. yd.	0.43	2,252.34	0.26	1,361.88	0.24	1,257.12	0.27	1,414.26
27	Corner bead	7,101.0	Lin. ft.	0.109	774.01	0.065	461.57	0.060	426.06	0.068	482.87
28	Cold water paint	890.0	Lb.	0.0663	59.01	0.0688	61.23	0.0683	60.79	0.0694	61.77
29	Filler, paste	249.0	Lb.	0.202	50.30	0.080	19.92	0.127	31.62	0.166	41.33
30	Turpentine	256.0	Gal.	1.740	445.44	0.668	171.01	1.124	287.74	1.286	329.22
31	Hollow tile	598.99	Tons	20.00	11,979.80	15.40	9,224.45	13.40	8,026.47	13.40	8,026.47
32	Door 1¾ in. quartered oak	3,149.0	Sq. ft.	2.660	8,376.34	1.765	5,557.99	1.908	6,008.29	2.298	7,236.40
33	Sash 1¾ in. quartered oak	2,702.0	Sq. ft.	1.041	2,812.78	0.762	2,058.92	0.706	1,907.61	0.817	2,207.53
34	Sash 1¾ in. white pine	6,999.0	Sq. ft.	1.041	7,285.96	0.762	5,333.24	0.706	4,941.29	0.817	5,718.18
35	Structural steel, fabricated and erected	16,305.66	Cwt.	4.07	66,364.04	3.08	50,221.43	3.10	50,547.55	3.81	62,124.56
	Total				$216,382.55		$167,526.31		$159,429.75		$183,971.07

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1900		1901		1902		1903	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
36	Cement	133.0	Bbl.	$ 1.89	$ 251.37	$ 1.62	$ 215.46	$ 1.68	$ 223.44	$ 1.76	$ 234.08
37	Lime	6.0	Bbl.	0.71	4.26	0.80	4.80	0.84	5.04	0.82	4.92
38	Sand and gravel	88.0	Cu. yd.	0.82	72.16	0.85	74.80	0.88	77.44	0.88	77.44
39	Granite cut	259.0	Cu. ft.	4.45	1,152.55	4.71	1,219.89	5.09	1,318.31	5.39	1,396.01
40	Limestone sawed 2 *S.*	1,373.0	Cu. ft.	0.88	1,208.24	0.88	1,208.24	0.88	1,208.24	0.88	1,208.24
41	Limestone sawed 4 *S.*	13,019.0	Cu. ft.	1.32	17,185.08	1.34	17,445.46	1.38	17,966.22	1.41	18,356.79
42	Marble, int. 1 in. thick	5,227.0	Sq. ft.	0.459	2,399.19	0.482	2,519.41	0.528	2,759.86	0.558	2,916.67
43	Marble, int. 2 in. thick	863.0	Sq. ft.	0.918	792.23	0.964	831.93	1.055	910.47	1.115	962.25
44	Skylight copper flat	60.0	Sq. ft.	0.544	32.64	0.532	31.92	0.455	27.30	0.558	33.48
45	Skylight copper hip	256.0	Sq. ft.	0.544	139.26	0.532	136.19	0.455	116.48	0.558	142.85
46	Gutter, copper 4 in	42.0	Lin. ft.	0.191	8.02	0.194	8.15	0.169	7.10	0.182	7.64
47	Leader, copper 3 in	10.0	Lin. ft.	0.236	2.36	0.239	2.39	0.210	2.10	0.226	2.26
48	Leader box, copper	2.0	Each	2.213	4.43	2.265	4.53	2.184	4.37	2.327	4.65
49	Leader-galvanized W.I. 5 in	266.0	Lin ft.	0.088	23.41	0.094	25.00	0.088	23.41	0.081	21.55
50	Roofing, 5 ply	58.48	Sq.	4.00	233.92	4.00	233.92	4.00	233.92	4.00	233.92
51	Mosaic floor	5,666.0	Sq. ft.	0.1534	869.16	0.1568	888.43	0.1568	888.43	0.1589	900.33
52	Iron stairs, ornamental	41,230.0	Lb.	0.0315	1,298.75	0.0323	1,331.73	0.0368	1,517.26	0.0362	1,492.53
53	Railing, type *SR*	121.0	Lin. ft.	0.899	108.78	0.874	105.75	0.847	102.49	0.719	87.00
54	Cast iron curb	1,588.0	Lb.	0.029	46.05	0.028	44.46	0.033	52.40	0.035	55.58
55	Flashing copper	1,634.0	Sq. ft.	0.2111	344.94	0.2132	348.37	0.1825	298.21	0.1968	321.57
56	Gutter lining copper	1,258.0	Sq. ft.	0.2188	275.25	0.2212	278.27	0.1909	240.15	0.2057	258.77
57	Cornice, molded copper	2,600.0	Sq. ft.	0.2188	568.88	0.2212	575.12	0.1909	496.34	0.2059	535.34
58	Siding, crimped copper	5.63	Sq	24.37	137.20	24.62	138.61	21.09	118.74	22.74	128.03
59	Consoles copper	88.0	Each	2.820	248.16	2.887	254.06	2.792	245.70	2.976	261.89
60	Dentils, copper	320.0	Each	0.310	99.20	0.315	100.80	0.300	96.00	0.323	103.36
61	Cylinders, copper	320.0	Each	0.122	39.04	0.124	39.68	0.122	39.04	0.131	41.92
62	Sunken panels, copper	81.0	Each	0.2049	16.60	0.2121	17.18	0.2251	18.23	0.2382	19.29
63	Egg and dart mold, copper	238.0	Lin. ft.	0.1537	36.58	0.1591	37.87	0.1688	40.17	0.1786	42.51
64	Coal hole	150.0	Lb.	0.029	4.35	0.028	4.20	0.033	4.95	0.035	5.25
65	Cast iron saddles	73.0	Lb.	0.029	2.12	0.028	2.04	0.033	2.41	0.035	2.56
	Total				$27,604.18		$28,128.66		$29,044.22		$29,858.68
	Total, plus 12 per cent				$30,916.68		$31,504.10		$32,529.53		$33,441.72

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1904		1905		1906		1907	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
36	Cement	133.0	Bbl.	$ 1 19	$ 158.27	$ 1.16	$ 154.28	$ 1 38	$ 183.54	$ 1.46	$ 194.18
37	Lime	6.0	Bbl.	0.86	5.16	0 92	5.52	0.98	5.88	0.99	5.94
38	Sand and gravel	88.0	Cu. yd	0.89	78 32	0.89	78.32	0.95	83 60	0 99	87.12
39	Granite cut	259.0	Cu. ft.	5.67	1,468.53	5.72	1,481.48	5.88	1,522.92	6.55	1,696 45
40	Limestone sawed 2 *S.*	1,373.0	Cu. ft.	0.88	1,208.24	0.88	1,208.24	1 03	1,414.19	1.04	1,427.92
41	Limestone sawed 4 *S.*	13,019.0	Cu. ft.	1.45	18,877.55	1.45	18,877.55	1.62	21,090 78	1.70	22,132.30
42	Marble, int. 1 in. thick	5,227.0	Sq. ft.	0.588	3,073 48	0.596	3,115.29	0.612	3,198.92	0.688	3,596.18
43	Marble, int. 2 in thick	863.0	Sq. ft.	1.175	1,014.03	1.190	1,026 97	1.223	1,055.45	1.374	1,185.76
44	Skylight copper flat	60.0	Sq. ft.	0.439	26.34	0.460	27 60	0.501	30 06	0.544	32 64
45	Skylight copper hip	256.0	Sq. ft.	0.439	112.38	0.460	117.76	0.501	128.26	0.544	139.26
46	Gutter, copper 4 in	42 0	Lin. ft.	0.173	7.27	0 189	7.94	0.222	9 32	0.256	10.75
47	Leader, copper 3 in	10 0	Lin. ft.	0.214	2.14	0 234	2.34	0.274	2.74	0.316	3.16
48	Leader box, copper	2.0	each	2.281	4.56	2.400	4.80	2.634	5.27	2.889	5.78
49	Leader-galvanized W.I. 5 in	266.0	Lin. ft.	0 074	19.68	0.077	20 48	0.080	21.28	0.083	22.08
50	Roofing, 5 ply	58.48	Sq.	4.00	233 92	4.00	233 92	4.00	233.92	4.00	233.92
51	Mosaic floor	5,666 0	Sq. ft.	0 1600	906 56	0.1545	875 40	0.1512	856.70	0.1545	875.40
52	Iron stairs, ornamental	41,230.0	Lb.	0.0349	1,438 93	0.0374	1,542 00	0 0379	1,562 62	0.0398	1,640.95
53	Railing, type *SR*	121 0	Lin. ft.	0.681	82.40	0.705	85.31	0.661	79 98	0.772	93.41
54	Cast iron curb	1,588.0	Lb.	0 029	46 05	0.033	52.40	0.038	60.34	0.039	61 93
55	Flashing copper	1,634.0	Sq. ft.	0.1849	302 13	0 2040	333 34	0.2431	397.23	0.2841	464.22
56	Gutter lining copper	1,258.0	Sq. ft.	0 1938	243 80	0.2131	268 08	0.2524	317.52	0.2939	369.73
57	Cornice, molded copper	2,600 0	Sq. ft.	0.1940	504 40	0 2134	554 84	0 2527	657.02	0.2937	763.62
58	Siding, crimped copper	5.63	Sq.	21 36	120.26	23.56	132.64	28 06	157.98	32.80	184.66
59	Consoles, copper	88.0	Each	2.918	256.78	3.067	269 90	3.359	295.59	3.679	323 75
60	Denti's, copper	320 0	Each	0 315	100 80	0.335	107 20	0.369	118.08	0.401	128 32
61	Cylinders, copper	320 0	Each	0 128	40 96	0.136	43.52	0.146	46 72	0.156	49.92
62	Sunken panels, copper	81.0	Each	0.2402	19.46	0.2444	19 80	0 2511	20 34	0.2598	21.04
63	Egg and dart mold, copper	238.0	Lin. ft.	0.1802	42.89	0.1833	43 63	0.1883	44.82	0.1949	46 39
64	Coal hole	150 0	Lb.	0.029	4.35	0.033	4.95	0.038	5.70	0.039	5 85
65	Cast iron saddles	73.0	Lb.	0.029	2.12	0 033	2 41	0.038	2.77	0.039	2.85
	Total				$30,401.76		$30,697.91		$33,609.54		$35,805.48
	Total, plus 12 per cent				$34,049.97		$34,381.66		$37,642.68		$40,102.14

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1908		1909		1910		1911	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
36	Cement	133.0	Bbl.	$ 1.27	$ 168.91	$ 1.23	$ 163.59	$ 1 26	$ 167.58	$ 1.20	$ 159.60
37	Lime	6.0	Bbl.	1.08	6.48	1.08	6.48	1.08	6.48	1.15	6.90
38	Sand and gravel	88 0	Cu. yd.	1 09	95 92	1 09	95 92	1.16	102.08	1.16	102.08
39	Granite cut	259.0	Cu. ft.	6.57	1,701 63	6 61	1,711.99	6 73	1,743 07	6.75	1,748.25
40	Limestone sawed 2 *S*	1,373.0	Cu. ft.	1 04	1,427.92	1 19	1,633 87	1 19	1,633.87	1.19	1,633 87
41	Limestone sawed 4 *S*	13,019.0	Cu. ft.	1 70	22,132 30	1.86	24,215 34	1 87	24,345 53	1.87	24,345 53
42	Marble, int. 1 in. thick	5,227.0	Sq. ft.	0.690	3,606 63	0 690	3,606 63	0 706	3,690 26	0.706	3,690.26
43	Marble, int. 2 in. thick	863.0	Sq. ft.	1.378	1,189 21	1 378	1,189 21	1.411	1,217 69	1.411	1,217 69
44	Skylight copper flat	60.0	Sq. ft.	0 400	24 00	0 426	25 56	0.467	28 02	0.435	26 10
45	Skylight copper hip	256.0	Sq. ft.	0.400	102 40	0.426	109.06	0.467	119 55	0.435	111 36
46	Gutter, copper 4 in	42 0	Lin. ft.	0.173	7.27	0.174	7.31	0.176	7.39	0.164	6 89
47	Leader, copper 3 in	10.0	Lin. ft.	0.217	2.17	0.218	2.18	0.225	2.25	0.207	2 07
48	Leader box, copper	2 0	Each	2 417	4 83	2.468	4 94	2.525	5.05	2.474	4.95
49	Leader-galvanized W.I. 5 in	266 0	Lin. ft.	0.081	21 55	0 078	20 75	0 080	21.28	0.075	19.95
50	Roofing, 5 ply	58.48	Sq.	4 00	233 92	4 00	233.92	4.00	233.92	4.00	238 92
51	Mosaic floor	5,666 0	Sq. ft.	0.1436	813 64	0.1512	856 70	0.1556	881 63	0.1545	875.40
52	Iron stairs ornamental	41,230 0	Lb.	0.0364	1,500 77	0.0374	1,542 00	0.0384	1,583 23	0.0365	1,504 90
53	Railing, type *SR*	121 0	Lin. ft.	0.775	93 78	0.667	80 71	0.656	79.38	0.625	75 63
54	Cast iron curb	1,588 0	Lb.	0.031	49 23	0.031	49.23	0.029	46 05	0.026	41 29
55	Flashing copper	1,634 0	Sq. ft.	0.1842	300 98	0.1843	301 15	0.1856	303 27	0.1716	280 39
56	Gutter lining copper	1,258 0	Sq. ft.	0.1942	244 30	0 1947	244.93	0.1962	246.82	0.1824	229.46
57	Cornice, molded copper	2,600 0	Sq. ft.	0.1940	504 40	0 1943	505.18	0.1960	509 60	0.1821	473 46
58	Siding, crimped copper	5 63	Sq.	21.31	119 98	21 34	120.14	21.48	120.93	19.88	111 92
59	Consoles, copper	88 0	Each	3.096	272 45	3.162	278 26	3.235	284 68	3.173	279.22
60	Dentils, Copper	320 0	Each	0.325	104 00	0 330	105.60	0.338	108.16	0.329	105.28
61	Cylinders, copper	320 0	Each	0.134	42 88	0.137	43.84	0.140	44.80	0.138	44.16
62	Sunken panels, copper	81 0	Each	0 2648	21.45	0.2736	22 16	0.2826	22 89	0.2858	23.15
63	Egg and dart mold, copper	238 0	Lin. ft.	0.1986	47 27	0 2052	48.84	0 2119	50.43	0.2144	51.03
64	Coal hole	150 0	Lb.	0.031	4.65	0 031	4.65	0.029	4.35	0.026	3.90
65	Cast iron saddles	73.0	Lb.	0.031	2.26	0.031	2.26	0.029	2.12	0.026	1.90
	Total				34,847.18		37,232.40		37,612.36		37,410.51
	Total, plus 12 per cent				$39,028.84		$41,700.29		$42,125.84		$41,899 77

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—*(Continued)*

	Item	Quantity	Unit	1920		1921		1922		1923	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
36	Cement	133.0	Bbl.	$ 3.44	$ 457.52	$ 2.67	$ 355.11	$ 2.36	$ 313.88	$ 2.50	$ 332.50
37	Lime	6.0	Bbl.	3.78	22.68	3.92	23.52	3.94	23.64	4.01	24.06
38	Sand and gravel	88.0	Cu. yd.	3.01	264.88	2.62	230.56	2.23	196.24	2.80	246.40
39	Granite cut	259.0	Cu. ft.	13.10	3,392.90	13.84	3,584.56	12.26	3,175.34	13.77	3,565.43
40	Limestone sawed 2 *S.*	1,373.0	Cu. ft.	1.86	2,553.78	1.86	2,553.78	1.73	2,375.29	1.85	2,540.05
41	Limestone sawed 4 *S.*	13,019.0	Cu. ft.	3.17	41,270.23	3.24	42,181.56	2.96	38,536.24	3.24	42,181.56
42	Marble, int. 1 in. thick	5,227.0	Sq. ft.	1.380	7,213.26	1.447	7,563.47	1.282	6,701.01	1.451	7,584.38
43	Marble, int. 2 in. thick	863.0	Sq. ft.	2.759	2,381.02	2.894	2,497.52	2.564	2,212.73	2.902	2,504.43
44	Skylight copper flat	60.0	Sq. ft.	0.823	49.38	0.703	42.18	0.709	42.54	0.858	51.48
45	Skylight copper hip	256.0	Sq. ft.	0.823	210.69	0.703	179.97	0.709	181.50	0.858	219.65
46	Gutter, copper 4 in	42.0	Lin. ft.	0.291	12.22	0.228	9.58	0.221	9.28	0.254	10.67
47	Leader, copper 3 in	10.0	Lin. ft.	0.379	3.79	0.302	3.02	0.284	2.84	0.330	3.30
48	Leader box, copper	2.0	Each	5.265	10.53	4.970	9.94	4.296	8.59	5.071	10.14
49	Leader-galvanized W.I. 5 in	266.0	Lin. ft.	0.170	45.22	0.133	35.38	0.119	31.65	0.135	35.91
50	Roofing, 5 ply	58.48	Sq.	11.01	643.86	10.40	608.19	10.40	608.19	11.20	654.98
51	Mosaic floor	5,666.0	Sq. ft.	0.4384	2,483.97	0.3375	1,912.28	0.2937	1,664.10	0.2937	1,664.10
52	Iron stairs ornamental	41,230.0	Lb.	0.0905	3,731.32	0.0725	2,989.18	0.0650	2,679.95	0.0771	3,178.83
53	Railing, type *SR*	121.0	Lin. ft.	1.270	153.67	1.290	156.09	1.207	146.05	1.404	169.88
54	Cast iron curb	1,588.0	Lb.	0.089	141.33	0.066	104.81	0.055	87.34	0.072	114.34
55	Flashing copper	1,634.0	Sq. ft.	0.2957	483.17	0.2164	353.60	0.2141	349.84	0.2458	401.64
56	Gutter lining copper	1,258.0	Sq. ft.	0.3224	405.58	0.2435	306.32	0.2358	296.64	0.2721	342.30
57	Cornice, molded copper	2,600.0	Sq. ft.	0.3176	825.76	0.2396	622.96	0.2349	610.74	0.2698	701.48
58	Siding, crimped copper	5.63	Sq.	34.50	194.24	25.35	142.72	24.91	140.24	28.66	161.36
59	Consoles, copper	88.0	Each	6.776	596.29	6.418	564.78	5.539	487.43	6.539	575.43
60	Dentils, copper	320.0	Each	0.637	203.84	0.596	190.72	0.550	176.00	0.634	202.88
61	Cylinders, copper	320.0	Each	0.273	87.36	0.266	85.12	0.243	77.76	0.280	89.60
62	Sunken panels, copper	81.0	Each	0.6687	54.16	0.6870	55.65	0.5707	46.23	0.6792	55.02
63	Egg and dart mold, copper	238.0	Lin. ft.	0.5015	119.36	0.5153	122.64	0.4280	101.86	0.5094	121.24
64	Coal hole	150.0	Lb.	0.089	13.35	0.066	9.90	0.055	8.25	0.072	10.80
65	Cast iron saddles	73.0	Lb.	0.089	6.50	0.066	4.82	0.055	4.02	0.072	5.26
	Total				$68,031.86		$67,499.93		$61,295.41		$67,759.10
	Total, plus 12 per cent				$76,195.68		$75,599.92		$68,650.86		$75,890.19

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1900		1901		1902		1903	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
66	Bricklayer	15,323	Hr.	$0.4733	$ 7,252.38	$0.5088	$ 7,796.34	$0.5434	$ 8,326.52	$0.5643	$ 8,646.77
67	Carpenter	11,099	Hr.	0.3479	3,861.34	0.3614	4,011.18	0.3890	4,317.51	0.4135	4,589.44
68	Lather	1,171	Hr.	0.3507	410.67	0.3629	424.96	0.3782	442.87	0.3729	436.67
69	Laborer, building	32,594	Hr.	0.1703	5,550.76	0.1776	5,788.69	0.1867	6,085.30	0.1928	6,284.12
70	Laborer, excavating	9,809	Hr.	0.1852	1,816.63	0.1910	1,873.52	0.1971	1,933.35	0.1985	1,947.09
71	Laborer, excavating	8,321	Hr.								
72	Laborer, excavating	6,831	Hr.								
73	Laborer, excavating	5,343	Hr.								
74	Laborer, excavating	3,854	Hr.								
75	Laborer, excavating	2,365	Hr.								
76	Team work, excavating	2,877	Hr.	0.39	1,122.03	0.41	1,179.57	0.42	1,208.34	0.42	1,208.34
77	Steam shovel	31	Hr.								
78	Steam shovel	63	Hr.								
79	Steam shovel	94	Hr.								
80	Steam shovel	125	Hr.								
81	Steam shovel	157	Hr.								
82	Hoisting engineer	34	Hr.								
83	Hoisting engineer	69	Hr.								
84	Hoisting engineer	103	Hr.								
85	Hoisting engineer	138	Hr.								
86	Hoisting engineer	173	Hr.								
87	Painters	7,346	Hr.	0.3176	2,333.09	0.3283	2,411.69	0.3466	2,546.12	0.3665	2,692.31
88	Plasterers	4,265	Hr.	0.4393	1,873.61	0.4660	1,987.49	0.4959	2,115.01	0.5267	2,246.38
89	Hoisting engineer	1,015	Hr.	0.394	399.91	0.413	419.20	0.438	444.57	0.457	463.86
90	Hoist	1,015	Hr.	0.39	395.85	0.35	355.25	0.37	375.55	0.39	395.85
91	Mixer	268	Hr.	1.125	301.50	1.125	301.50	1.125	301.50	1.125	301.50
92	Mixer engineer	268	Hr.	0.394	105.59	0.413	110.68	0.438	117.38	0.457	122.48
93	Plumbers	45	Hr.	0.4021	18.09	0.4094	18.42	0.4264	19.19	0.4650	20.93
94	Laborers, excavating for C.I. drain	243	Hr.	0.1852	45.00	0.1910	46.41	0.1971	47.90	0.1985	48.24
	Total				$25,486.45		$26,724.90		$28,281.11		$29,403.98

NOTE.—Labor hours include 10 per cent for field superintendence.

ESTIMATED AVERAGE COST OF A TYPICAL FIRE PROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1904		1905		1906		1907	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
66	Bricklayer	15,323	Hr.	$0.5677	$ 8,698.87	$0.5938	$ 9,098.80	$0.6037	$ 9,250.50	$0.6069	$ 9,299.53
67	Carpenter	11,099	Hr.	0.4061	4,507.30	0.4265	4,733.72	0.4412	4,896.88	0.4647	5,157.71
68	Lather	1,171	Hr.	0.4203	492.17	0.4492	526.01	0.4353	509.74	0.4397	514.89
69	Laborer, building	32,594	Hr.	0.1947	6,346.05	0.1931	6,293.90	0.2028	6,610.06	0.2255	7,349.95
70	Laborer, excavating	9,809	Hr.	0.1996	1,957.88						
71	Laborer, excavating	8,321	Hr.	.....	.....	0.2008	1,670.86				
72	Laborer, excavating	6,831	Hr.	.....	.....	.....	.....	0.2146	1,465.93		
73	Laborer, excavating	5,343	Hr.	.....	.....	.....	.....	.....	.....	0.2224	1,188.28
74	Laborer, excavating	3,854	Hr.								
75	Laborer, excavating	2,365	Hr.								
76	Team work, excavating	2,877	Hr.	0.43	1,237.11	0.43	1,237.11	0.46	1,323.42	0.47	1,352.19
77	Steam shovel	31	Hr.	.....	.....	2.50	77.50				
78	Steam shovel	63	Hr.	.....	.....	.....	.....	2.50	157.50		
79	Steam shovel	94	Hr.	.....	.....	.....	.....	.....	.....	2.50	235.00
80	Steam shovel	125	Hr.								
81	Steam shovel	157	Hr.								
82	Hoisting engineer	34	Hr.	.....	.....	0.488	16.59				
83	Hoisting engineer	69	Hr.	.....	.....	.....	.....	0.501	34.57		
84	Hoisting engineer	103	Hr.	.....	.....	.....	.....	.....	.....	0.513	52.84
85	Hoisting engineer	138	Hr.								
86	Hoisting engineer	173	Hr.								
87	Painters	7,346	Hr.	0.3775	2,773.12	0.3879	2,849.51	0.3979	2,922.97	0.4145	3,044.92
88	Plasterers	4,265	Hr.	0.5440	2,320.16	0.5653	2,411.00	0.5860	2,499 29	0 6028	2,570.94
89	Hoisting engineer	1,015	Hr.	0 476	483.14	0.488	495.32	0 501	508.52	0.513	520 70
90	Hoist	1,015	Hr.	0 39	395.85	0.41	416.15	0.49	497.35	0.50	507.50
91	Mixer	268	Hr.	1 125	301.50	1.125	301.50	1.125	301.50	1.125	301.50
92	Mixer engineer	268	Hr.	0.476	127.57	0.488	130.78	0 501	134.27	0.513	137.48
93	Plumbers	45	Hr.	0 4765	21.44	0.4792	21.56	0 4938	22.22	0.5081	22.86
94	Laborers, excavating for C.I. drain	243	Hr.	0.1996	48.50	0.2008	48.79	0.2146	52.15	0.2224	54.04
	Total	.....	.....	.....	$29,710.66	.....	$30,329.10	.....	$31,186.87	.....	$32,310.33

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1908		1909		1910		1911	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
66	Bricklayer	15,323	Hr.	$0.6121	$ 9,379.21	$0.6157	$ 9,434.37	$0.6286	$ 9,632.04	$0.6286	$ 9,632.04
67	Carpenter	11,099	Hr.	0.4656	5,167.69	0.4765	5,288.67	0.4951	5,495.11	0.5000	5,549.50
68	Lather	1,171	Hr.	0.4701	550.49	0.4723	576.48	0.5114	598.85	0.5305	621.22
69	Laborer, building	32,594	Hr.	0.2276	7,418.39	0.2391	7,793.23	0.2439	7,949 68	0.2476	8,070.27
70	Laborer, excavating	9,809	Hr.								
71	Laborer, excavating	8,321	Hr.								
72	Laborer, excavating	6,831	Hr.								
73	Laborer, excavating	5,343	Hr.								
74	Laborer, excavating	3,854	Hr.	0.2469	951.55						
75	Laborer, excavating	2,365	Hr.	.....	.....	0.2469	583.92	0.2594	613.48	0.2594	613.48
76	Team work, excavating	2,877	Hr.	0.52	1,496.04	0.52	1,496.04	0.55	1,582.35	0.55	1,582.35
77	Steam shovel	31	Hr.								
78	Steam shovel	63	Hr.								
79	Steam shovel	94	Hr.								
80	Steam shovel	125	Hr.	2.50	312.50						
81	Steam shovel	157	Hr.	.....	.....	2.75	431.75	2.75	431.75	2.75	431.75
82	Hoisting engineer	34	Hr.								
83	Hoisting engineer	69	Hr.								
84	Hoisting engineer	103	Hr.								
85	Hoisting engineer	138	Hr.	0.526	72.59						
86	Hoisting engineer	173	Hr.	.....	.....	0.545	94.29	0.557	96.36	0.570	98.61
87	Painters	7,346	Hr.	0.4195	3,081.65	0.4248	3,120.58	0.4419	3,246.20	0.4575	3,360.80
88	Plasterers	4,265	Hr.	0.5938	2,532.56	0.6055	2,582.46	0.6223	2,654.11	0.6268	2,673.30
89	Hoisting engineer	1,015	Hr.	0.526	544 04	0.545	553.18	0.557	565.36	0.570	578.55
90	Hoist	1,015	Hr.	0.46	466.90	0.45	456.75	0.46	466.90	0.46	466.90
91	Mixer	268	Hr.	1.125	301 50	1.375	368.50	1 375	368.50	1.375	368.50
92	Mixer engineer	268	Hr.	0.526	140.97	0.545	146.06	0 557	149.28	0.570	152.76
93	Plumbers	45	Hr.	0.5112	23.00	0.5259	23.67	0.5375	24.19	0.5481	24.66
94	Laborers, excavating for C.I. drain	243	Hr	0.2469	60.00	0.2469	60.00	0.2594	63.03	0.2594	63.03
	Total	.....	.....	.....	$32,499.08	.....	$33,009.95	.....	$33,937.19	.....	$34,287.72

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1912		1913		1914		1915	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
66	Bricklayer	15,323	Hr.	$0.6357	$ 9,740.83	$0.6589	$10,096.32	$0.6744	$10,333.83	$0.6834	$10,471.74
67	Carpenter	11,099	Hr.	0.5094	5,653.83	0.5223	5,797.01	0.5376	5,966.82	0.5491	6,094.46
68	Lather	1,171	Hr.	0.5509	645.10	0.5760	674.50	0.5966	698.62	0.5846	684.57
69	Laborer, building	32,594	Hr.	0.2591	8,445.11	0.2633	8,582.00	0.2798	9,119.80	0.2760	8,995.94
70	Laborer, excavating	9,809	Hr.								
71	Laborer, excavating	8,321	Hr.								
72	Laborer, excavating	6,831	Hr.								
73	Laborer, excavating	5,343	Hr.								
74	Laborer, excavating	3,854	Hr.								
75	Laborer, excavating	2,365	Hr.	0.2750	650.38	0.2800	662.20	0.2829	669.06	0.2864	677.34
76	Team work, excavating	2,877	Hr.	0.58	1,668.66	0.59	1,697.43	0.60	1,726.20	0.61	1,754.97
77	Steam shovel	31	Hr.								
78	Steam shovel	63	Hr.								
79	Steam shovel	94	Hr.								
80	Steam shovel	125	Hr.								
81	Steam shovel	157	Hr.	2.75	431.75	2.88	452.16	2.88	452.16	3.00	471.00
82	Hoisting engineer	34	Hr.								
83	Hoisting engineer	69	Hr.								
84	Hoisting engineer	103	Hr.								
85	Hoisting engineer	138	Hr.								
86	Hoisting engineer	173	Hr.	0.586	101.38	0.608	105.18	0.626	108.30	0.643	111.24
87	Painters	7,346	Hr.	0.4685	3,441.60	0.4862	3,571.63	0.5019	3,686.96	0.5028	3,693.57
88	Plasterers	4,265	Hr.	0.6313	2,692.49	0.6500	2,772.25	0.6590	2,810.64	0.6693	2,854.56
89	Hoisting engineer	1,015	Hr.	0.586	594.79	0.608	617.12	0.626	635.39	0.643	652.65
90	Hoist	1,015	Hr.	0.48	487.20	0.49	497.35	0.47	477.05	0.46	466.90
91	Mixer	268	Hr.	1.375	368.50	1.375	368.50	1.375	368.50	1.375	368.50
92	Mixer engineer	268	Hr.	0.586	157.05	0.608	162.94	0.626	167.77	0.643	172.32
93	Plumbers	45	Hr.	0.5612	25.25	0.5862	26.38	0.6023	27.10	0.6113	27.51
94	Laborers, excavating for C.I. drain	243	Hr.	0.2750	66.83	0.2800	68.04	0.2829	68.74	0.2864	69.60
	Total				$35,170.75		$36,151.01		$37,316.94		$37,566.87

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1916		1917		1918		1919	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
66	Bricklayer	15,323	Hr.	$0 6911	$10,589.73	$0.7357	$11,273 13	$0.7938	$12,163.40	$0 9036	$13,845.86
67	Carpenter	11,099	Hr.	0 5653	6,274 26	0 6213	6,895 81	0 6784	7,529 56	0.7786	8,641.68
68	Lather	1,171	Hr.	0 6096	713.84	0 6595	772.27	0 7126	834.45	0.7805	913.97
69	Laborer, building	32,594	Hr.	0.3124	10,182 37	0.3607	11,756.66	0.4659	15,185.54	0.5391	17,571.43
70	Laborer, excavating	9,809	Hr.								
71	Laborer, excavating	8,321	Hr.								
72	Laborer, excavating	6,831	Hr.								
73	Laborer, excavating	5,343	Hr.								
74	Laborer, excavating	3,854	Hr.								
75	Laborer, excavating	2,365	Hr.	0.3043	719.67	0.3500	827.75	0 4210	995.67	0.4517	1,068.27
76	Team work, excavating	2,877	Hr.	0.65	1,870.05	0 74	2,128.98	0.89	2,560.53	0.96	2,761.92
77	Steam shovel	31	Hr.								
78	Steam shovel	63	Hr.								
79	Steam shovel	94	Hr.								
80	Steam shovel	125	Hr.								
81	Steam shovel	157	Hr.	3.00	471.00	3.63	569.91	3.75	588.75	4.25	667.25
82	Hoisting engineer	34	Hr.								
83	Hoisting engineer	69	Hr.								
84	Hoisting engineer	103	Hr.								
85	Hoisting engineer	138	Hr.								
86	Hoisting engineer	173	Hr.	0.647	111.93	0.671	116.08	0.781	135.11	0.859	148.61
87	Painters	7,346	Hr.	0.5325	3,911 75	0.5617	4,126.25	0.6465	4,749.19	0.7402	5,437 51
88	Plasterers	4,265	Hr.	0.6831	2,913.42	0.7134	3,042.65	0.7470	3,185.96	0.8679	3,701.59
89	Hoisting engineer	1,015	Hr.	0.647	656.71	0.671	681.07	0.781	792.72	0.859	871.89
90	Hoist	1,015	Hr.	0 53	537 95	0.64	649.60	0.76	771 40	0.91	923.65
91	Mixer	268	Hr.	1.375	368 50	1.500	402.00	1.625	435 50	1.625	435 50
92	Mixer engineer	268	Hr.	0.647	173 40	0.671	179.83	0.781	209 31	0.859	230.21
93	Plumbers	45	Hr.	0.6180	27 81	0.6546	29 46	0.7331	32.99	0.8331	37.49
94	Laborers, excavating for C.I. drain	243	Hr.	0.3043	73.94	0.3500	85.05	0.4210	102.30	0.4517	109.76
	Total				$39,596.33		$43,536.50		$50,272.38		$57,366.59

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1920		1921		1922		1923	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
66	Bricklayer	15,323	Hr.	$1.1661	$17,868.15	$1.2268	$18,798.26	$1.1670	$17,881.94	$1.3250	$20,183.73
67	Carpenter	11,099	Hr.	1.0268	11,396.45	1.0679	11,852.62	0.9582	10,635.06	1.0866	12,060.17
68	Lather	1,171	Hr.	1.0456	1,224.40	1.0863	1,272.06	1.0100	1,182.71	1.1711	1,371.36
69	Laborer, building	32,594	Hr.	0.6967	22,708.24	0.6871	22,395.34	0.5027	16,385.00	0.6312	20,573.33
70	Laborer, excavating	9,809	Hr.								
71	Laborer, excavating	8,321	Hr.								
72	Laborer, excavating	6,831	Hr.								
73	Laborer, excavating	5,343	Hr.								
74	Laborer, excavating	3,854	Hr.								
75	Laborer, excavating	2,365	Hr.	0.6770	1,601.11	0.5898	1,394.88	0.4786	1,131.89	0.5754	1,360.82
76	Team work, excavating	2,877	Hr.	1.43	4,114.11	1.25	3,596.25	1.01	2,905.77	1.22	3,509.94
77	Steam shovel	31	Hr.								
78	Steam shovel	63	Hr.								
79	Steam shovel	94	Hr.								
80	Steam shovel	125	Hr.								
81	Steam shovel	157	Hr.	4.50	706.50	4.50	706.50	5.00	785.00	5.00	785.00
82	Hoisting engineer	34	Hr.								
83	Hoisting engineer	69	Hr.								
84	Hoisting engineer	103	Hr.								
85	Hoisting engineer	138	Hr.								
86	Hoisting engineer	173	Hr.	1.048	181.30	1.110	192.03	1.030	178.19	1.1266	194.90
87	Painters	7,346	Hr.	1.0000	7,346.00	1.0339	7,595.03	0.9175	6,739.96	1.0330	7,588.42
88	Plasterers	4,265	Hr.	1.1241	4,794.29	1.2411	5,293.29	1.1436	4,877.45	1.3571	5,788.03
89	Hoisting engineer	1,015	Hr.	1.048	1,063.72	1.1110	1,126.65	1.030	1,045.45	1.1266	1,143.50
90	Hoist	1,015	Hr.	1.10	1,116.50	0.91	923.65	0.88	893.20	0.97	984.55
91	Mixer	268	Hr.	1.750	469.00	1.750	469.00	1.875	502.50	1.875	502.50
92	Mixer engineer	268	Hr.	1.048	280.86	1.110	297.48	1.030	276.04	1.1266	301.93
93	Plumbers	45	Hr.	1.0188	45.85	1.1018	49.58	1.0175	45.79	1.1379	51.21
94	Laborers, excavating for C.I. drain	243	Hr.	0.6770	164.51	0.5898	143.32	0.4786	122.16	0.5754	139.82
	Total				$75,080.99		$76,105.94		$65,588.11		$76,539.21

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1900		1901		1902		1903	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
95	Marble setters	1,044	Hr.	$0.4661	$ 486.61	$0.4922	$ 513.86	$0.4814	$ 502.58	$0.5032	$ 525.34
96	Metal workers, sheet	518	Hr.	0.3420	177.16	0.3527	182.70	0.3760	194.77	0.4076	208.55
97	Hoisting engineer	741	Hr.	0.394	291.95	0.413	306.03	0.438	324.56	0.457	338.64
98	Derrick and engine	685	Hr.	1.5375	1,053.19	1.5375	1,053.19	1.5375	1,053.19	1.5375	1,053.19
99	Hoist	56	Hr.	0.39	21.84	0.35	19.60	0.37	20.72	0.39	21.84
100	Engine (fo· hoist)	56	Hr.	1.00	56.00	1.00	56.00	1.00	56.00	1.00	56.00
101	Stone mason	1,961	Hr.	0.3659	717.53	0.3865	757.93	0.4201	823.82	0.4453	873.23
102	Tile setters	700	Hr.	0.4661	326.27	0.4922	344.54	0.4814	336.98	0.5032	352.24
103	Iron setters, ornamental	2,556	Hr.	0.3051	779.84	0.3567	911.73	0.3972	1,015.24	0.4151	1,061.00
104	Laborers, building	9,400	Hr	0.1703	1,600.82	0.1776	1,669.44	0.1867	1,754.98	0.1928	1,812.32
105	Mixer	13	Hr.	1.125	14.63	1.125	14.63	1.125	14.63	1.125	14.63
106	Mixer engineer	13	Hr.	0.394	5.12	0.413	5.37	0.438	5.69	0.457	5.94
	Total				$ 5,530.96		$ 5,835.02		$ 6,103.16		$ 6,322.92
	Total, plus 12 per cent				$ 6,194.68		$ 6,535.22		$ 6,835.54		$ 7,081.67

Note.—Labor hours include 10 per cent for field superintendence.

Summary

	1900	1901	1902	1903
Material				
General contractor work	$105,678.63	$ 96,909.00	$104,618.02	$199,809.91
Sub-contractor work	30,916.68	31,504.10	32,529.53	33,441.72
Total, material	$136,595.31	$128,413.10	$137,147.55	$133,251.63
Labor				
General contractor work	$ 25,486.45	$ 26,724.90	$ 28,281.11	$ 29,403.98
Sub-contractor work	6,194.68	6,535.22	6,835.54	7,081.67
Total, labor	$ 31,681.13	$ 33,260.12	$ 35,116.65	$ 36,485.65
Total, material and labor	$168,276.44	$161,673.22	$172,264.20	$169,737.28
Per cent of 1914 cost	$ 92.04	$ 88.42	$ 94.22	$ 92.84
Reciprocal	1.086	1.131	1.061	1.077

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1904		1905		1906		1907	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
95	Marble setters	1,044	Hr.	$0.5233	$ 546.33	$0.5297	$ 553.01	$0.5312	$ 554.57	$0.5330	$ 556.45
96	Metal workers, sheet	518	Hr.	0.4059	210.26	0.4179	216.47	0.4250	220.15	0.4241	219.68
97	Hoisting engineer	741	Hr.	0.476	352.72	0.488	361.61	0.501	371.24	0.513	380.13
98	Derrick and engine	685	Hr.	1.5375	1,053.19	1.5375	1,053.19	1.5375	1,053.19	1.5375	1,053.19
99	Hoist	56	Hr.	0.39	21.84	0.41	22.96	0.49	27.44	0.50	28.00
100	Engine (for hoist)	56	Hr.	1.00	56.00	1.00	56.00	1.00	56.00	1.00	56.00
101	Stone mason	1,961	Hr.	0.4709	923.43	0.4757	932.85	0.4899	960.69	0.5496	1,077.77
102	Tile setters	700	Hr.	0.5233	366.31	0.5297	370.79	0.5312	371.84	0.5466	382.62
103	Iron setters, ornamental	2,556	Hr.	0.4529	1,157.61	0.4678	1,195.70	0.4633	1,184.19	0.4795	1,225.60
104	Laborers, building	9,400	Hr.	0.1947	1,830.18	0.1931	1,815.14	0.2028	1,906.32	0.2255	2,119.70
105	Mixer	13	Hr.	1.125	14.63	1.125	14.63	1.125	14.63	1.125	14.63
106	Mixer engineer	13	Hr.	0.476	6.19	0.488	6.34	0.501	6.51	0.513	6.67
	Total				$ 6,538.69		$ 6,598.69		$ 6,726.77		$ 7,120.44
	Total, plus 12 per cent				$ 7,323.33		$ 7,390.53		$ 7,533.98		$ 7,974.89

Summary

Material				
General contractor work	$ 95,353.51	$ 99,358.94	$105,737.75	$103,768.19
Sub-contractor work	34,049.97	34,381.66	37,642.68	40,102.14
Total, material	$129,403.48	$133,740.60	$143,380.43	$143,870.33
Labor				
General contractor work	$ 29,710.66	$ 30,329.10	$ 31,186.87	$ 32,310.33
Sub-contractor work	7,323.33	7,390.53	7,533.98	7,974.89
Total, labor	$ 37,033.99	$ 37,719.63	$ 38,720.85	$ 40,285.22
Total, material and labor	$166,437.47	$171,460.23	$182,101.28	$184,155.55
Per cent of 1914 cost	91.03	93.78	99.60	100.72
Reciprocal	1.099	1.066	1.004	0.993

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1908		1909		1910		1911	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
95	Marble setters	1,044	Hr.	$0.5116	$ 534.11	$0.5241	$ 547.16	$0.5643	$ 589.13	$0.5705	$ 595.60
96	Metal workers, sheet	518	Hr.	0.4343	224.97	0.4450	230 51	0.4625	239.58	0.4670	241 91
97	Hoisting engineer	741	Hr.	0.526	389.77	0.545	403 85	0.557	412.74	0.570	422 37
98	Derrick and engine	685	Hr.	1.5375	1,053.19	1.7438	1,194 50	1.7438	1,194.50	1.7438	1,194.50
99	Hoist	56	Hr.	0.46	25.76	0.45	25 20	0.46	25.76	0.46	25.76
100	Engine (for hoist)	56	Hr.	1.00	56 00	1.13	63.28	1 13	63.28	1.13	63.28
101	Stone mason	1,961	Hr.	0.5514	1,081 30	0.5548	1,087 96	0.5645	1,106 98	0.5663	1,110 51
102	Tile setters	700	Hr.	0.5419	383 53	0.5533	387 31	0.5657	395 99	0.5688	398.16
103	Iron setters, ornamental	2,556	Hr.	0.4979	1,272 63	0.5071	1,296.15	0.5098	1,303.05	0 5143	1,314.55
104	Laborers, building	9,400	Hr.	0.2276	2,139.44	0.2391	2,247.54	0.2439	2,292.66	0.2476	2,327.44
105	Mixer	13	Hr.	1 125	14.63	1.375	17.88	1.375	17.88	1.375	17.88
106	Mixer engineer	13	Hr.	0.526	6 84	0.545	7.09	0.557	7.24	0.570	7.41
	Total				$ 7,182 17		$ 7,508.43		$ 7,648.79		$ 7,719.37
	Total, plus 12 per cent				$ 8,044.03		$ 8,409.44		$ 8,566.64		$ 8,645.69

Summary

	1908	1909	1910	1911
Material				
General contractor work	$ 98,832.15	$ 93,949.16	$ 95,092.85	$ 90,820.10
Sub-contractor work	39,028.84	41,700 29	42,125.84	41,899.77
Total, material	$137,860.99	$135,649.45	$137,218.69	$132,719.87
Labor				
General contractor work	$ 32,499.08	$ 33,009.95	$ 33,937.19	$ 34,287.72
Sub-contractor work	8,044.03	8,409.44	8,566.64	8,645.69
Total, labor	40,543.11	41,419.39	42,503.83	42,933.41
Total, material and labor	$178,404.10	$177,068.84	$179.722.52	$175,653.28
Per cent of 1914 cost	97.58	96.85	98.30	96.07
Reciprocal	1.025	1.033	1.017	1.041

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1912		1913		1914		1915	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
95	Marble setters	1,044	Hr.	$0.5732	$ 598.42	$0.6168	$ 643.94	$0.6301	$ 657.82	$0.6653	$ 694.57
96	Metal workers, sheet	518	Hr.	0 4810	249.16	0.5060	262.11	0.5267	272.83	0.5362	277.75
97	Hoisting engineer	741	Hr.	0.586	434 23	0 608	450.53	0.626	463.87	0.643	476.46
98	Derrick and engine	685	Hr.	1 743S	1,194.50	1.7500	1,198.75	1.7500	1,198.75	2.0563	1,408.57
99	Hoist	56	Hr.	0.48	26 88	0.49	27.44	0.47	26.32	0.46	25.76
100	Engine (for hoist)	56	Hr.	1 13	63.28	1 13	63.28	1 13	63.28	1.38	77.28
101	Stone mason	1,961	Hr.	0 5698	1,117.38	0.5920	1.160 91	0 6200	1,215.82	0 6298	1,235.04
102	Tile setters	700	Hr.	0 5804	406.28	0.5996	419.72	0 6114	427 98	0.6203	434.21
103	Iron setters, ornamental	2.556	Hr.	0 5424	1,386 37	0.5795	1,481.20	0.6206	1,586.25	0.6206	1,586.25
104	Laborers, building	9,400	Hr.	0 2591	2,435.54	0.2633	2,475.02	0.2798	2,630.12	0.2760	2,594.40
105	Mixer	13	Hr.	1.375	17.88	1.375	17 88	1 375	17.88	1.375	17.88
106	Mixer engineer	13	Hr.	0.586	7.62	0.608	7.90	0.626	8.14	0.643	8.36
	Total				$ 7,937.54		$ 8,208.68		$ 8,569.06		$ 8,836.53
	Total, plus 12 per cent				$ 8,890.04		$ 9,193.72		$ 9,597.35		$ 9,896.91

Summary

	1912	1913	1914	1915
Material				
General contractor work	$ 92,061.02	$ 98,781.26	$ 92,893.77	$ 93,456.76
Sub-contractor work	42,486.92	43,452.25	43,028.99	44,997.60
Total, material	$134,547.94	$142,233.51	$135,922.76	$138,454.36
Labor				
General contractor work	$ 35,170.75	$ 36,151.01	$ 37,316.94	$ 37,566.87
Sub-contractor work	8,890.04	9,193.72	9,597.35	9,896.91
Total, labor	$ 44,060.79	$ 45,344.73	$ 46,914.29	$ 47,463.78
Total, material and labor	$178,608.73	$187,578.24	$182,837.05	$185,918.14
Per cent of 1914 cost	97.69	102.59	100.00	101.69
Reciprocal	1 024	0 975	1 000	0.983

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1916		1917		1918		1919	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
95	Marble setters	1,044	Hr.	$0.6902	$ 720.57	$0.6911	$ 721.51	$0.7256	$ 757.53	$0.8027	$ 838.02
96	Metal workers, sheet	518	Hr.	0.5424	280.96	0.5661	293.24	0.6492	336.29	0.7471	387.00
97	Hoisting engineer	741	Hr.	0.647	479.43	0.671	497.21	0.781	578.72	0.859	636.52
98	Derrick and engine	685	Hr.	2.0563	1,408.57	2.2688	1,554.13	2.4438	1,674.00	2.4813	1,699.69
99	Hoist	56	Hr.	0.53	29.68	0.64	35.84	0.76	42.56	0.91	50.96
100	Engine (for hoist)	56	Hr.	1.38	77.28	1.50	84.00	1.63	91.28	1.63	91.28
101	Stone mason	1,961	Hr.	0.6357	1,246.61	0.6714	1,316.62	0.7286	1,428.78	0.8232	1,614.30
102	Tile setters	700	Hr.	0.6395	447.65	0.6635	464.45	0.6838	478.66	0.7407	518.49
103	Iron setters, ornamental	2,556	Hr.	0.6331	1,618.20	0.6824	1,744.21	0.7840	2,003.90	0.8786	2,245.70
104	Laborers, building	9,400	Hr.	0.3124	2,936.56	0.3607	3,390.58	0.4659	4,379.46	0.5391	5,067.54
105	Mixer	13	Hr.	1.375	17.88	1.500	19.50	1.625	21.13	1.625	21.13
106	Mixer engineer	13	Hr.	0.647	8.41	0.671	8.72	0.781	10.15	0.859	11.17
	Total				$ 9,271.80		$ 10,130.01		$ 11,802.46		$ 13,181.80
	Total, plus 12 per cent				$ 10,384.42		$ 11,345.61		$ 13,218.76		$ 14,763.62

Summary

	1916	1917	1918	1919
Material				
General contractor work	$130,306.82	$156,292.50	$169,978.73	$169,519.46
Sub-contractor work	48,927.48	51,644.19	54,534.50	63,717.11
Total, material	$179,234.30	$207,936.69	$224,513.23	$233,236.57
Labor				
General contractor work	$ 39,596.33	$ 43,536.60	$ 50,272.38	$ 57,366.59
Sub-contractor work	10,384.42	11,345.61	13,218.76	14,763.62
Total, labor	$ 49,980.75	$ 54,882.11	$ 63,491.14	$ 72,130.21
Total, material and labor	$229,215.05	$262,818.80	$288,004.37	$305,366.78
Per cent of 1914 cost	125.37	143.74	157.52	167.02
Reciprocal	0.798	0.696	0.635	0.599

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING EXCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

	Item	Quantity	Unit	1920		1921		1922		1923	
				Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
95	Marble setters	1,044	Hr.	$1 0053	$ 1,049 53	$1 0583	$ 1,104 87	$1 0080	$ 1,052 35	$1 1884	$ 1,240 69
96	Metal workers, sheet	518	Hr.	0 9750	505 05	1 0304	533 75	0 9240	478 63	1 0669	552 65
97	Hoisting engineer	741	Hr.	1 048	776 57	1 110	822 51	1 030	763 23	1 1266	834 81
98	Derrick and engine	685	Hr.	2 6688	1,828 13	2 6688	1,828 13	2 8688	1,965 13	2 8688	1,965 13
99	Hoist	56	Hr.	1 10	61 60	0 91	50 96	0 88	49 28	0 97	54 32
100	Engine (for hoist)	56	Hr.	1 75	98 00	1 75	98 00	1 88	105 28	1 88	105 28
101	Stone mason	1,961	Hr.	1 0911	2,139 65	1 1536	2,262 21	1 0240	2,008 06	1 1557	2,266 33
102	Tile setters	700	Hr.	1 0269	718 83	1 0229	716 03	0 9904	693 28	1 1864	830 48
103	Iron setters, ornamental	2,556	Hr.	1 1004	2,812 62	1 0982	2,807 00	0 9982	2,551 40	1 0990	2,809 04
104	Laborers, building	9,400	Hr.	0 6967	6,548 98	0 6871	6,458 74	0 5027	4,725 38	0 6312	5,933 28
105	Mixer	13	Hr.	1 750	22 75	1 750	22 75	1 875	24 38	1 875	24 38
106	Mixer engineer	13	Hr.	1 048	13 62	1 110	14 43	1 030	13 39	1 1266	14 65
	Total				$ 16,575 33		$ 16,719 38		$ 14,429 79		$ 16,631 04
	Total, plus 12 per cent				$ 18,564 37		$ 18,725 71		$ 16,161 36		$ 18,626 76

Summary

	1920	1921	1922	1923
Material				
General contractor work	$216,382 55	$167,526 31	$159,429 75	$183,971 07
Sub-contractor work	76,195 68	75,599 92	68,650 86	75,890 19
Total, material	$292,578 23	$243,126 23	$228,080 61	$259,861 26
Labor				
General contractor work	$ 75,080 99	$ 76,105 94	$ 65,588 11	$ 76,539 21
Sub-contractor work	18,564 37	18,725 71	16,161 36	18,626 76
Total, labor	$ 93,645 36	$ 94,831 65	$ 81,749 47	$ 95,165 97
Total, material and labor	$386,223 59	$337,957 88	$309,830 08	$355,027 23
Per cent of 1914 cost	211 24	184 84	169 46	194 18
Reciprocal	0 473	0 541	0 590	0 515

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING INCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

Item	Quantity	Unit	1900		1901		1902		1903	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Sub-contractor work										
Plumbing										
Water closets	18	Each								
Urinals	18	Each	.....	$ 4,345.36	.....	$ 4,290.61	.....	$ 4,335.62	.....	$ 4,475.28
Lavatories	18	Each								
Heating	8,903	Sq. ft.	$ 0.99	8,813.97	$ 1.02	9,081.06	$ 1.13	10,060.39	$ 1.12	9,971.36
Lighting	470	Outlets	11.06	5,198.20	11.06	5,198.20	11.06	5,198.20	11.06	5,198.20
Elevators	2	Each	4,468.23	8,936.46	4,426.61	8,853.22	4,667.13	9,334.26	4,209.70	8,419.40
Total			.....	$ 27,293.99	.....	$ 27,423.09	.....	$ 28,928.47	.....	$ 28,064.24
Total, plus 12 per cent			.....	$ 30,569.27	.....	$ 30,713.86	.....	$ 32,399.89	.....	$ 31,431.95
Total, general contractor and sub-contractor work, labor and material (brought forward from other sheet)				$168,276.44		$161,673.22		$172,264.20		$169,737.28
Grand total				$198,845.71		$192,387.08		$204,664.09		$201,169.23
Per cent of 1914 cost				93.02		90.00		95.75		94.11
Reciprocal				1.075		1.111		1.044		1.063

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING INCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

Item	Quantity	Unit	1904		1905		1906		1907	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Sub-contractor work										
Plumbing										
Water closets	18	Each								
Urinals	18	Each	.....	$ 4,431.66	.....	$ 4,516.11	.....	$ 4,634.90	.....	$ 4,856.69
Lavatories	18	Each								
Heating	8,903	Sq. ft.	$ 1.02	9,081.06	$ 1.09	9,704.27	$ 1.19	10,594.57	$ 1.26	11,217.78
Lighting	470	Outlets	11 06	5,198 20	10.84	5,094.80	12.29	5,776.30	12.33	5,795.10
Elevators	2	Each	3,953.58	7,907.16	3,668.63	7,347.26	3,872.34	7,744.68	3,943.97	7,887.94
Total	.....	.....	.....	$ 26,618.08	.....	$ 26,652.44	.....	$ 28,750.45	.....	$ 29,757.51
Total, plus 12 per cent	.....	.....	.....	$ 29,812.25	.....	$ 29,850.73	.....	$ 32,200.50	.....	$ 33,328.41
Total, general contractor and sub-contractor work, labor and material (brought forward from other sheet)				$166,437.47		$171,460.23		$182,101.28		$184,155.55
Grand total				$196,249.72		$201,310.96		$214,301.78		$217,483.96
Per cent of 1914 cost				91.81		94.18		100.25		101.74
Reciprocal				1.089		1.062		0.998		0.983

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING INCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

Item	Quantity	Unit	1908		1909		1910		1911	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Sub-contractor work										
Plumbing										
Water closets	18	Each								
Urinals	18	Each	.....	$ 4,642.32	.....	$ 4,498.94	.....	$ 4,675.26	.....	$ 4,560.66
Lavatories	18	Each								
Heating	8,903	Sq. ft.	$ 1.19	10,594.57	$ 1.10	9,793.30	$ 1.08	9,615.24	$ 1.06	9,437.18
Lighting	470	Outlets	12.26	5,762.20	11.53	5,419.10	11.86	5,574.20	11.23	5,278.10
Elevators	2	Each	3,852.73	7,705.46	3,780.09	7,578.18	3,893.15	7,786.30	3,850.72	7,701.44
Total			.....	$ 28,704.55	.....	$ 27,289.52	.....	$ 27,651.00	.....	$ 26,977.38
Total, plus 12 per cent			.....	$ 32,149.10	.....	$ 30,564.26	.....	$ 30,969.12	.....	$ 30,214.67
Total, general contractor and sub-contractor work, labor and material (brought forward from other sheet)				$178,404.10		$177,068.84		$179,722.52		$175,653.28
Grand total				$210,553.20		$207,633.10		$210,691.64		$205,867.95
Per cent of 1914 cost				98.50		97.13		98.57		96.31
Reciprocal				1.015		1.030		1.015		1.038

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING INCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

Item	Quantity	Unit	1912		1913		1914		1915	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Sub-contractor work										
Plumbing										
Water closets	18	Each					$100.00	$ 1,800.00		
Urinals	18	Each	.....	$ 4,641.39	.....	$ 4,718.88	100.00	1,800.00	.....	$ 4,781.52
Lavatories	18	Each					60.00	1,040.00		
Heating	8,903	Sq. ft.	$ 1.11	9,882.33	$ 1.15	10,238.45	1.10	9,793.30	$ 1.12	9,971.36
Lighting	470	Outlets	11.30	5,311.00	11.51	5,409.70	11.00	5,170.00	11.57	5,437.90
Elevators	2	Each	3,933.57	7,867.14	4,105.25	8,210.50	4,002.00	8,004.00	4,207.70	8,415.40
Total	.....	.....	.....	$ 27,701.86	.....	$ 28,577.53	.....	$ 27,607.30	.....	$ 28,606.18
Total, plus 12 per cent	.....	.....	.....	$ 31,026.08	.....	$ 32,006.83	.....	$ 30,920.18	.....	$ 32,038.92
Total, general contractor and sub-contractor work, labor and material (brought forward from other sheet)				$178,608.73		$187,578.24		$182,837.05		$185,918.14
Grand total				$209.634.81		$219,585.07		$213,757.23		$217,957.06
Per cent of 1914 cost				98.07		102.73		100.00		101.96
Reciprocal				1.020		0.973		1.000		0.98

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING INCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—(*Continued*)

Item	Quantity	Unit	1916		1917		1918		1919	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Sub-contractor work										
Plumbing										
Water closets	18	Each								
Urinals	18	Each	.....	$ 5,127.20	.....	$ 5,825.98	.....	$ 5,939.20	.....	$ 6,278.38
Lavatories	18	Each								
Heating	8,903	Sq. ft.	$ 1.42	12,642.26	$ 1.91	17,004.73	$ 2.22	19,764.66	$ 1.99	17,716.97
Lighting	470	Outlets	12.67	5,954.90	15.09	7,092.30	17.25	8,107.50	21.58	10,142.60
Elevators	2	Each	5,028.51	10,057.02	5,592.39	11,184.78	6,064.23	12,128.46	6,281.54	12,563.08
Total			.....	$ 33,781.38	.....	$ 41,107.79	.....	$ 45,939.82	.....	$ 46,701.03
Total, plus 12 per cent			.....	$ 37,835.15	.....	$ 46,040.72	.....	$ 51,452.60	.....	$ 52,305.15
Total, general contractor and sub-contractor work, labor and material (brought forward from other sheet)				$229,215.05		$262,818.80		$288,004.37		$305,366.78
Grand total				$267,050.20		$308,859.52		$339,456.97		$357,671.93
Per cent of 1914 cost				124.93		144.49		158.80		167.33
Reciprocal				0.800		0.692		0.630		0.59

ESTIMATED AVERAGE COST OF A TYPICAL FIREPROOF OFFICE BUILDING INCLUDING PLUMBING, HEATING, LIGHTING AND ELEVATORS.—*(Continued)*

Item	Quantity	Unit	1920		1921		1922		1923	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Sub-contractor work										
Plumbing										
Water closets	18	Each								
Urinals	18	Each	.....	$ 8,833.63	.....	$ 9,883.20	.....	$ 9,526.85	.....	$ 10,415.87
Lavatories	18	Each								
Heating	8,903	Sq. ft.	$ 2.40	21,367.20	$ 2.04	18,162.12	$ 1.85	16,470.55	$ 2.19	19,497.57
Lighting	470	Outlets	20.71	9,733.70	17.58	8,262.60	15.02	7,059.40	17.08	8,027.60
Elevators	2	Each	7,412.10	14,824.20	6,900.65	13,801.30	6,579.69	13,159.38	7,362.08	14,724.16
Total			.....	$ 54,758.73	.....	$ 50,109.22	.....	$ 46,216.18	.....	$ 52,665.20
Total, plus 12 per cent			.....	$ 61,329.78	.....	$ 56,122.33	.....	$ 51,762.12	.....	$ 58,985.02
Total, general contractor and sub-contractor work, labor and material (brought forward from other sheet)				$386,223.59		$337,957.88		$309,830.08		$355,027.23
Grand total				$447,553.37		$394,080.21		$361,592.20		$414,012.25
Per cent of 1914 cost				209.37		184.36		169.16		193.68
Reciprocal				0.478		0.542		0.591		0.516

Estimated Average Cost of a Typical Frame Shop Building with Wooden Roof Trusses

Item	Quantity	Unit	1890		1891		1892		1893		1894	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Rubble stone	109.6	C.Y.	$ 0.91	$ 99.74	$ 0.91	$ 99.74	$ 0.91	$ 99.74	$ 0.96	$ 105.22	$ 0.96	$ 105.22
Cement	58.5	Bbl.	2.18	127.53	2.18	127.53	2.18	127.53	2.46	143.91	2.03	118.76
Sand	25.9	C.Y.	0.69	17.87	0.69	17.87	0.69	17.87	0.73	18.91	0.72	18.65
Lime (300 lb. bbls.)	10.4	Bbl.	1.00	10.40	0.94	9.78	0.96	9.98	0.96	9.98	0.87	9.05
Cinders	234.6	C.Y.	0.44	103.22	0.45	105.57	0.43	100.88	0.42	98.53	0.41	96.19
Nails	25.6	Kegs	2.97	76.03	2.47	63.23	2.19	56.06	1.99	50.94	1.65	42.24
Simple framing, Y.P.	25.059	M.B.M.	20.62	516.72	19.31	483.89	18.19	455.82	17.82	446.55	17.46	437.53
Truss framing, Y.P.	10.625	M.B.M.	31.12	330.65	28.23	299.94	26.54	281.99	25.91	275.29	24.89	264.46
Wrought iron	36.23	Cwt.	2.99	108.33	2.87	103.98	2.84	102.89	2.67	96.73	2.25	81.52
W.P. drop siding	7.227	M.B.M.	26.05	188.26	23.61	170.63	24.07	173.95	24.50	177.06	24.39	176.27
Hemlock undersheathing	6.775	M.B.M.	18.86	127.78	17.66	119.65	16.63	112.67	16.30	110.43	15.96	108.13
Interior sheathing	2.994	M.B.M.	26.95	80.69	25.79	77.22	24.44	73.17	24.19	72.42	22.58	67.60
Plank flooring	36.106	M.B.M.	31.43	1,134.81	28.51	1,029.38	26.81	968.00	26.17	944.89	25.14	907.70
Pitch and gravel roofing	79.38	Sq.	4.48	355.62	4.48	355.62	4.48	355.62	4.48	355.62	4.48	355.62
Windows (wood)	1,453.0	S.F.	0.24	348.72	0.22	319.66	0.22	319.66	0.22	319.66	0.19	276.07
Doors (engine house)	252.0	S.F.	0.28	70.56	0.27	68.04	0.27	68.04	0.27	68.04	0.26	65.52
Lead and oil paint	69.2	Gal.	1.20	83.04	1.13	78.20	1.09	75.43	1.07	74.04	1.00	69.20
Cold water paint	1.78	Cwt.	1.78	3.17	1.65	2.94	1.68	2.99	1.68	2.99	1.53	2.72
Total cost of material				$3,783.14		$3,532.87		$3,402.29		$3,371.21		$3,202.45
Laborer (excavating)	1,019.0	Hr.	$ 0.155	157.95	$ 0.157	159.98	$ 0.157	159.98	$ 0.163	166.10	$ 0.162	165.08
Laborer (building)	1,136.6	Hr.	0.161	182.99	0.163	185.27	0.163	185.27	0.162	184.13	0.162	184.13
Stone mason	301.4	Hr.	0.357	107.60	0.354	106.70	0.352	106.09	0.352	106.09	0.337	101.57
Hod carrier	301.4	Hr.	0.240	72.34	0.241	72.64	0.244	73.54	0.242	72.94	0.244	73.54
Carpenter	2,009.4	Hr.	0.292	586.74	0.298	598.80	0.302	606.84	0.308	618.90	0.303	608.85
Painter	269.0	Hr.	0.285	76.67	0.287	77.20	0.291	78.28	0.296	79.62	0.294	79.09
Total cost of labor				$1,184.29		$1,200.59		$1,210.00		$1,227.78		$1,212.26
Grand total				$4,967.43		$4,733.46		$4,612.29		$4,598.99		$4,414.71
Per cent of 1914 cost				78.78		75.07		73.15		72.94		70.01
Reciprocal				1.269		1.332		1.367		1.371		1.428

ESTIMATED AVERAGE COST OF A TYPICAL FRAME SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unint	1895		1896		1897		1898		1899	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Rubble stone	109.6	C.Y.	$ 0.95	$ 104 12	$ 0.96	$ 105.22	$ 0.97	$ 106.31	$ 1.04	$ 113.98	$ 1.04	$ 113.98
Cement	58.5	Bbl.	1.69	98 87	1.73	101.21	1.69	98.87	1.72	100.62	1.77	103.55
Sand	25 9	C.Y.	0 73	18 91	0.73	18.91	0.74	19.17	0.80	20.72	0.80	20.72
Lime (300 lb. bbl.)	10.4	Bbl.	0.81	8.42	0.72	7.49	0.75	7.80	0.77	8.01	0.82	8.53
Cinders	234 6	C.Y.	0.40	93 84	0.40	93.84	0.38	89.15	0.37	86.80	0.35	82.11
Nails	25.6	Kegs	2.12	54.27	2.93	75.01	1.49	38.14	1.44	36.86	2.39	61.18
Simple framing, Y.P.	25.059	M.B.M.	16.46	412.47	17 22	431.52	16.93	424.25	16.91	423.75	19.71	493.91
Truss framing, Y.P.	10.625	M.B.M.	22 96	243 95	24.89	264.46	24.19	257.02	24.56	260 95	28.41	301 86
Wrought iron	36.23	Cwt.	2.39	86 59	2.36	85.50	2.33	84 42	2 32	84.05	3.13	113 40
W.P. drop siding	7.227	M.B.M.	21.77	157 33	20.85	150.68	20.82	150.47	20.71	149.67	23.72	171.42
Hemlock undersheathing	6.775	M.B.M.	15.05	101.96	15.75	106 71	15.48	104 88	15.46	104.74	18 02	122.09
Interior sheathing	2.994	M.B.M.	19.91	59 61	18.21	54.52	17.12	51.26	17.06	51.08	24.19	72.42
Plank flooring	36.106	M.B.M.	23.19	837.30	25.14	907.70	24.44	882.43	24.80	895.43	28.70	1,036.24
Pitch and gravel roofing	79.38	Sq.	4 48	355 62	4.48	355.62	4.48	355.62	4.48	355 62	4.48	355.62
Windows (wood)	1,453.0	S.F.	0.17	247.01	0.16	232.48	0.16	232 48	0 18	261 54	0.23	334.19
Doors (engine house)	252.0	S.F.	0.25	63.00	0.25	63.00	0.24	60 48	0.24	60.48	0.28	70.56
Lead and oil paint	69.2	Gal.	1 01	69.89	0.91	62.97	0.91	62 97	0.95	65.74	1.01	69.89
Cold water paint	1.78	Cwt.	1.41	2.51	1.26	2.24	1.30	2.31	1.35	2.40	1.44	2.56
Total cost of material				$3,015.67		$3,119.08		$3,028.03		$3,082.44		$3,534.23
Laborer (excavating)	1,019.0	Hr.	$ 0.163	166.10	$ 0.164	167 12	$ 0.167	170.17	$ 0.182	185.46	$ 0.181	184.44
Laborer (building)	1,136.0	Hr.	0.160	181 86	0.161	182 99	0.162	184 13	0.163	185 27	0.162	184 13
Stone mason	301.4	Hr.	0.337	101 57	0.350	105.49	0.351	105.79	0.351	105.79	0.358	107.90
Hod carrier	301.4	Hr.	0.241	72 64	0.244	73.54	0.241	72 64	0.244	73.54	0.250	75.35
Carpenter	2,009.4	Hr.	0.295	592.77	0.297	596.79	0.296	594 78	0.307	616.89	0.315	632.96
Painter	269.0	Hr.	0.292	78.55	0.294	79.09	0.294	79.09	0.297	79.89	0.305	82.05
Total cost of labor				$1,193.49		$1,205.02		$1,206.60		$1,246.84		$1,266.83
Grand total				$4,209.16		$4,324.10		$4,234.63		$4,329.28		$4,801.06
Per cent of 1914 cost				66.75		68.58		67.16		68.66		76.14
Reciprocal				1.498		1.458		1.489		1.456		1.313

ESTIMATED AVERAGE COST OF A TYPICAL FRAME SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1900		1901		1902		1903		1904	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Rubble stone	109.6	C.Y.	$ 1.07	$ 117.27	$ 1.11	$ 121.66	$ 1.17	$ 128.23	$ 1.18	$ 129.33	$ 1.19	$ 130.42
Cement	58.5	Bbl.	1.89	110.57	1.62	94.77	1.68	98.28	1.76	102.96	1.19	69.62
Sand	25.9	C.Y.	0.82	21.24	0.85	22.02	0.88	22.79	0.88	22.79	0.89	23.05
Lime (300 lb. bbl.)	10.4	Bbl.	0.71	7 38	0.80	8.32	0.84	8.74	0.82	8.53	0.86	8.94
Cinders	234.6	C.Y.	0.41	96.19	0.43	100.88	0.43	100.88	0.44	103.22	0.44	103.22
Nails	25.6	Kegs	2.63	67.33	2.37	60.67	2.10	53.76	2.08	53.25	1.91	48.90
Simple framing, Y.P.	25 059	M.B.M.	22.38	560.82	19.65	492.41	20.78	520.73	21.69	543.53	22.01	551.55
Truss framing, Y.P.	10.625	M.B.M.	30.97	329.06	26.79	284.64	28.35	301.22	29.23	310.57	29.74	315.99
Wrought iron	36 23	Cwt.	3.14	113.76	3.22	116.66	3.67	132.96	3.61	130.79	3.48	126.08
W.P. drop siding	7.227	M.B.M.	26.83	193.90	26.51	191.59	28.67	207.20	29.95	216.45	31.01	224.11
Hemlock undersheathing	6.775	M.B.M.	20.46	138.62	17.97	121.75	19.00	128.73	19.84	134.42	20.13	136.38
Interior sheathing	2.994	M.B.M.	24.78	74.19	24.54	73.47	25.25	75.60	25.21	75.48	25.21	75.48
Plank flooring	36.106	M.B.M.	31.28	1,129.40	27.05	976.67	28.63	1,033.71	29.52	1,065.85	30.03	1,094.26
Pitch and gravel roofing	79.38	Sq.	4.48	355.62	4.48	355.62	4.48	355.62	4.48	355.62	4.48	355.62
Windows (wood)	1,453 0	S.F.	0.27	392.31	0.33	479.49	0.35	508.55	0.29	421.37	0.29	421.37
Doors (engine house)	252 0	S.F.	0.31	78.12	0.32	80.64	0.35	88.20	0.36	90.72	0.36	90.72
Lead and oil paint	69 2	Gal.	1.21	83.73	1.15	79.58	1.09	75.43	1.09	75.43	1.06	73.35
Cold water paint	1.78	Cwt.	1.24	2.21	1.41	2.51	1.46	2.60	1.42	2.53	1.50	2.67
Total cost of material				$3,871.72		$3,663.35		$3,843.23		$3,842.84		$3,841.73
Laborer (excavating)	1,019.0	Hr.	$ 0.185	188.52	$ 0.191	194.63	$ 0.197	200.74	$ 0.198	201.76	$ 0.200	203.80
Laborer (building)	1,136.6	Hr.	0.170	193.22	0.178	202.31	0.187	212.54	0.193	219.36	0.195	221.64
Stone mason	301 4	Hr.	0.366	110.31	0.386	116.34	0.420	126.59	0.445	134.12	0.471	141.96
Hod carrier	301 4	Hr.	0.260	78.36	0.264	79.57	0.279	84.09	0.295	88.91	0.293	88.31
Carpenter	2,009.4	Hr.	0.348	699.27	0.361	725.39	0.389	781.66	0.414	831.99	0.406	815.82
Painter	269.0	Hr.	0.318	85.54	0.328	88.23	0.347	93.34	0.366	98.45	0.378	101.68
Total cost of labor				$1,355.22		$1,406.47		$1,498.96		$1,574.49		$1,573.21
Grand Total				$5,226.94		$5,069.82		$5,342.19		$5,417.33		$5,414.94
Per cent of 1914 cost				82.89		80.40		84.72		85.91		85.88
Reciprocal				1.206		1.244		1.180		1.164		1.164

ESTIMATED AVERAGE COST OF A TYPICAL FRAME SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1905		1906		1907		1908		1909	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Rubble stone	109.6	C.Y.	$ 1.20	$ 131 52	$ 1.21	$ 132.62	$ 1.23	$ 134.81	$ 1.24	$ 135.90	$ 1.25	$ 137.00
Cement	58.5	Bbl.	1.16	67.86	1.38	80.73	1.46	85.41	1.27	74.30	1.23	71.96
Sand	25.9	C.Y.	0.89	23.05	0.95	24 61	0.99	25 64	1.09	28.23	1.09	28.23
Lime (300 lb. bbl.)	10.4	Bbl.	0.92	9 57	0.98	10 19	0.99	10 30	1.08	11.23	1.08	11.23
Cinders	234.6	C.Y.	0.43	100.88	0.44	103 22	0.44	103 22	0.45	105 57	0.46	107.92
Nails	25.6	Kegs	1.90	48.64	1.96	50.18	2.12	54.27	2.10	53.76	1.92	49.15
Simple framing, Y.P.	25.059	M.B.M.	23.13	579 61	29.13	729.97	29 44	737.74	26.59	666.32	25.23	632.24
Truss framing, Y.P.	10.625	M.B.M.	31.34	332 99	40 10	426 06	40.43	429 57	35.52	377.40	32.78	348.29
Wrought iron	36.23	Cwt.	3.74	135.50	3.78	136.95	3.97	143.83	3.63	131.51	3.73	135.14
W.P. drop siding	7.227	M.B.M.	32.82	237.19	37.77	272.96	38.73	279.90	39.68	286.77	35.72	258.15
Hemlock undersheathing	6.775	M.B.M.	21.15	143.29	26.63	180.42	26.92	182.38	24.31	164.70	23.07	156.30
Interior sheathing	2.994	M.B.M.	26.21	78 47	31.54	94.43	32.18	96.35	32.25	96.56	31.99	95 78
Plank flooring	36.106	M.B.M.	31.65	1,142 75	40.50	1,462 29	40.84	1,474.57	35.88	1,295.48	33.11	1,195.47
Pitch and gravel roofing	79 38	Sq.	4.48	355 62	4.48	355 62	4.48	355.62	4.48	355 62	4.48	355.62
Windows (wood)	1,453.0	S.F.	0.31	450 43	0.31	450.43	0.33	479.49	0.31	450.43	0.31	450.43
Doors (engine house)	252.0	S.F.	0.38	95 76	0.41	103.32	0.42	105.84	0.42	105.84	0.41	103.32
Lead and oil paint	69.2	Gal.	1.14	78.89	1.18	81.66	1.20	83.04	1.14	78.89	1.22	84.42
Cold water paint	1.78	Cwt.	1.61	2.87	1.72	3 06	1.72	3.06	1.89	3.36	1.89	3.36
Total cost of material				$4,014 89		$4,698.72		$4,785.04		$4,421 87		$4,224.01
Laborer (excavating)	1,019.0	Hr.	$ 0.201	204.82	$ 0.215	219 09	$ 0.222	226.22	$ 0.247	251.69	$ 0.247	251 69
Laborer (building)	1,136.6	Hr.	0.193	219.36	0.203	230 73	0.226	256 87	0.228	259 14	0.239	271 65
Stone mason	301.4	Hr.	0 476	143.47	0.490	147.69	0.550	165.77	0.551	166 07	0.555	167.28
Hod carrier	301 4	Hr.	0.296	89.21	0.304	91.63	0.316	95.24	0.319	96.15	0.323	97.35
Carpenter	2,009.4	Hr.	0 426	856 00	0.441	886.15	0.465	934.37	0.466	936.38	0.476	956.47
Painter	269.0	Hr.	0.388	104.37	0 398	107.06	0.414	111 37	0.420	112.98	0.425	114.33
Total cost of labor				$1,617.23		$1,682.35		$1,789.84		$1,822.41		$1,858.77
Grand total				$5,632 12		$6,381 07		$6,574.88		$6,244.28		$6,082.78
Per cent of 1914 cost				89.32		101.20		104.27		99.03		96.47
Reciprocal				1.120		0.988		0.959		1.010		1.037

ESTIMATED AVERAGE COST OF A TYPICAL FRAME SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1910		1911		1912		1913		1914	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Rubble stone	109.6	C.Y.	$ 1.26	$ 138.10	$ 1.27	$ 139.19	$ 1.29	$ 141.38	$ 1.43	$ 156.73	$ 1.58	$ 173.17
Cement	58.5	Bbl.	1.26	73.71	1.20	70.20	1.06	62.01	1.32	77.22	1.32	77.22
Sand	25.9	C.Y.	1.16	30.04	1.16	30.04	1.22	31.60	1.24	32.12	1.25	32.38
Lime (300 lb. bbl.)	10.4	Bbl.	1.08	11.23	1.15	11.96	1.13	11.75	1.12	11.65	1.07	11.13
Cinders	234.6	C.Y.	0.47	110.26	0.47	110.26	0.48	112.61	0.48	112.61	0.48	112.61
Nails	25.6	Kegs	1.89	48.38	1.80	46.08	1.74	44.54	1.82	46.59	1.68	43.01
Simple framing, Y.P.	25.059	M.B.M.	25.67	643.26	26.20	656.55	27.16	680.60	28.03	702.40	26.17	655.79
Truss framing, Y.P.	10.625	M.B.M.	33.56	356.58	34.56	367.20	35.64	378.68	34.77	369.43	30.13	320.13
Wrought iron	36.23	Cwt.	3.83	138.76	3.64	131.88	3.85	139.49	4.17	151.08	4.00	144.92
W.P. drop siding	7.227	M.B.M.	35.79	258.65	35.72	258.15	35.61	257.35	36.92	266.82	35.40	255.84
Hemlock undersheathing	6.775	M.B.M.	23.48	159.08	23.95	162.26	24.84	168.29	25.63	173.64	23.93	162.13
Interior sheathing	2.994	M.B.M.	31.80	95.21	31.12	93.17	31.73	95.00	33.92	101.56	32.12	96.17
Plank flooring	36.106	M.B.M.	33.90	1,223.99	34.90	1,260.10	36.00	1,299.82	35.12	1,268.04	30.43	1,098.71
Pitch and gravel roofing	79.38	Sq.	4.48	355.62	4.48	355.62	4.48	355.62	4.03	319.90	4.87	386.58
Windows (wood)	1,453.0	S.F.	0.31	450.43	0.28	408.84	0.27	392.31	0.29	421.37	0.29	421.37
Doors (engine house)	252.0	S.F.	0.41	103.32	0.41	103.32	0.42	105.84	0.44	110.88	0.44	110.88
Lead and oil paint	69.2	Gal.	1.45	100.34	1.50	103.80	1.13	78.20	1.20	83.04	1.23	85.12
Cold water paint	1.78	Cwt.	1.89	3.36	2.00	3.56	1.96	3.49	1.94	3.45	1.85	3.29
Total cost of material				$4,300.32		$4,310.18		$4,358.58		$4,408.53		$4,190.45
Laborer (excavating)	1,019.0	Hr.	$ 0.259	263.92	$ 0.259	263.92	$ 0.275	280.23	$ 0.280	285.32	$ 0.283	288.38
Laborer (building)	1,136.6	Hr.	0.244	277.33	0.248	281.88	0.259	294.38	0.263	298.93	0.280	318.24
Stone mason	301.4	Hr.	0.564	169.99	0.566	170.59	0.570	171.80	0.592	178.43	0.620	186.87
Hod carrier	301.4	Hr.	0.332	100.06	0.336	101.27	0.340	102.48	0.345	103.98	0.350	105.49
Carpenter	2,009.4	Hr.	0.495	934.65	0.500	1,004.70	0.509	1,002.78	0.522	1,048.91	0.538	1,081.06
Painter	269.0	Hr.	0.442	118.90	0.458	123.20	0.468	125.89	0.486	130.73	0.502	135.04
Total cost of labor				$1,924.85		$1,945.56		$1,997.56		$2,046.30		$2,115.08
Grand total				$6,225.17		$6,255.74		$6,356.14		$6,454.83		$6,305.53
Per cent of 1914 cost				98.72		99.21		100.80		102.37		100.00
Reciprocal				1.013		1.008		0.992		0.977		1.000

ESTIMATED AVERAGE COST OF A TYPICAL FRAME SHOP BUILDING WITH WOODEN ROOF TRUSSES.—*(Continued)*

Item	Quantity	Unit	1915		1916		1917		1918		1919	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Rubble stone	109.6	C.Y.	$ 1.58	$ 173.17	$ 1.78	$ 195.09	$ 2.33	$ 255.37	$ 3.98	$ 436.21	$ 3.68	$ 403.33
Cement	58 5	Bbl.	1.19	69 62	1 44	84.24	1.85	108 23	2.27	132.80	2.73	159.71
Sand	25.9	C.Y.	1.27	32.89	1.35	34 97	1.56	40 40	1.87	48 43	2.01	52 06
Lime (300 lb. bbl.)	10 4	Bbl.	1 28	13 31	1.45	15 08	1.82	18 93	2.38	24.75	2.76	28.70
Cinders	234.6	C.Y.	0.50	117.30	0 51	119 65	0.55	129 03	0.69	161.87	0.75	175 95
Nails	25 6	Kegs	1.75	44 80	2 60	66 56	3.63	92 93	3.60	92.16	3 52	90 11
Simple framing, Y.P.	25 059	M.B.M.	24 97	625 72	29.47	738.49	36 53	915 41	44.91	1,125 40	54.64	1,369 22
Truss framing, Y.P.	10 625	M.B.M.	29 98	318.54	38 17	405 56	49.53	526 26	63 45	674 16	71 56	760 33
Wrought iron	36.23	Cwt.	4 15	150 35	5 73	207 60	7 23	261.94	7 59	274.99	7.15	259 04
W.P. drop siding	7.227	M.B.M.	34.62	250 20	33 88	244.85	45 03	325 43	53 56	387 08	63 08	455.88
Hemlock undersheathing	6.775	M.B.M.	22 83	154 67	26 95	182 59	33.41	226 35	41 06	278 18	49 97	338 55
Interior sheathing	2.994	M.B.M.	30 03	89 91	32 57	97 51	38 67	115 78	37 47	112 19	55 25	165 42
Plank flooring	36 106	M.B.M.	30.28	1,093 29	38 55	1,391.89	50 03	1,806 38	64.09	2,314 03	72.27	2,609.38
Pitch and gravel roofing	79 38	Sq.	5.02	398 49	3 07	481 84	7.03	558 04	8 05	639.01	10.58	839 84
Windows (wood)	1,453 0	S.F.	0.29	421 37	0 32	464 96	0.39	566 67	0.51	741 03	0 63	915.39
Doors (engine house)	252.0	S.F.	0.44	110 88	0 49	123 48	0.60	151 20	0.67	168 84	0.73	183 96
Lead and oil paint	69 2	Gal.	1 29	89 27	1 68	116 26	2.12	146.70	2.61	180 61	2.82	195 14
Cold water paint	1 78	Cwt.	2.24	3.99	2.54	4.52	3.18	5 66	4.18	7.44	4.83	8.60
Total cost of material				$4,157.77		$4,975.14		$6,250.71		$7,799 18		$9,010.61
Laborer (excavating)	1,019.0	Hr.	$ 0 286	291 43	$ 0 304	309 78	$ 0.350	356.65	$ 0.421	424.00	$ 0.452	460 59
Laborer (building)	1,136 6	Hr.	0.276	313 70	0 312	354 62	0.361	410 31	0.466	529.66	0.539	612 63
Stone mason	301 4	Hr.	0.630	189 88	0.636	191 69	0 671	202 24	0.729	211 72	0 823	248 05
Hod carrier	301.4	Hr.	0 352	106 09	0 372	112 12	0.421	126.89	0.501	151.00	0.601	181.14
Carpenter	2,009.4	Hr.	0 549	1,103 16	0.565	1,135 31	0.621	1,247 84	0.678	1,362.37	0.779	1,565 32
Painter	269.0	Hr.	0.503	135.31	0.532	143.11	0.562	151.18	0.646	173.77	0.740	199 06
Total cost of labor				$2,139 57		$2,246 63		$2,495.11		$2,857.52		$3,266 79
Grand total				$6,297 34		$7,221 77		$8,745.82		$10,656 70		$12,277 40
Per cent of 1914 cost				99.87		114 53		138 70		169 00		194.71
Reciprocal				1.001		0.873		0.721		0.592		0.514

ESTIMATED AVERAGE COST OF A TYPICAL FRAME SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1920		1921		1922		1923	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Rubble stone	109.6	C.Y.	$ 4.30	$ 471.28	$ 3.32	$ 363.87	$ 3.20	$ 350.72	$ 3.28	$ 359.40
Cement	58.5	Bbl.	3.44	201.24	2.67	156.20	2.36	138.06	2.50	146.25
Sand	25.9	C.Y.	3.01	77.96	2.62	67.86	2.22	57.50	2.77	71.74
Lime (300 lb. bbl.)	10.4	Bbl.	3.78	39.31	3.92	40.77	3.94	40.98	4.01	41.70
Cinders	234.6	C.Y.	0.98	229.91	0.98	229.91	0.87	204.10	0.90	211.14
Nails	25.6	Kegs	4.20	107.52	3.07	78.59	2.53	64.77	2.92	74.75
Simple framing, Y.P.	25.059	M.B.M.	64.64	1,619.81	50.06	1,254.45	50.06	1,254.45	54.25	1,359.45
Truss framing, Y.P.	10.625	M.B.M.	81.23	863.07	63.60	675.75	69.15	734.72	78.82	837.46
Wrought iron	36.23	Cwt.	9.03	327.16	7.23	261.94	6.48	234.77	7.57	274.26
W.P. drop siding	7.227	M.B.M.	113.95	823.52	72.99	527.50	83.90	606.35	90.59	654.69
Hemlock undersheathing	6.775	M.B.M.	59.11	400.48	45.78	310.16	45.78	310.16	49.61	336.11
Interior sheathing	2.994	M.B.M.	105.26	315.15	66.10	197.90	66.84	200.12	77.73	232.72
Plank flooring	36.106	M.B.M.	82.04	2,962.14	64.24	2,319.45	69.84	2,521.64	79.60	2,874.04
Pitch and gravel roofing	79.38	Sq.	12.33	978.76	11.65	924.78	11.65	924.78	12.54	995.43
Windows (wood)	1,453.0	S.F.	0.89	1,293.17	0.63	915.39	0.64	929.92	0.76	1,104.28
Doors (engine house)	252.0	S.F.	1.08	272.16	0.86	216.72	0.85	239.40	0.94	236.88
Lead and oil paint	69.2	Gal.	3.02	208.98	2.20	152.24	2.19	151.55	2.26	156.39
Cold water paint	1.78	Cwt.	6.63	11.80	6.88	12.25	6.97	12.41	7.07	12.58
Total cost of material				$11,203.42		$ 8,705.73		$ 8,976.40		$ 9,979.36
Laborer (excavating)	1,019.0	Hr.	$ 0.677	689.87	$ 0.590	601.21	$ 0.479	488.10	$ 0.575	585.93
Laborer (building)	1,136.6	Hr.	0.697	792.21	0.687	780.84	0.503	571.71	0.631	717.19
Stone mason	301.4	Hr.	1.091	328.83	1.154	347.82	1.024	308.63	1.156	348.42
Hod carrier	301.4	Hr.	0.786	236.90	0.802	241.72	0.672	202.54	0.845	254.68
Carpenter	2,009.4	Hr.	1.027	2,063.65	1.068	2,146.04	0.958	1,925.01	1.087	2,184.22
Painter	269.0	Hr.	1.000	269.00	1.034	278.15	0.918	246.94	1.033	277.88
Total cost of labor				$ 4,380.46		$ 4,395.78		$ 3,742.93		$ 4,368.32
Grand total				$15,583.88		$13,101.51		$12,719.33		$14,347.68
Per cent of 1914 cost				247.14		207.78		201.72		227.54
Reciprocal				0.405		0.481		0.496		0.439

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH WOODEN TRUSSES

Item	Quantity	Unit	1890		1891		1892		1893		1894	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	730.4	Bbl.	$ 2.18	$ 1,592.27	$ 2.18	$ 1,592.27	$ 2.18	$ 1,592.27	$ 2.46	$ 1,796.78	$ 2.03	$ 1,482.71
Lime (300 lb. bbl.)	93.5	Bbl.	1.00	93.50	0.94	87.89	0.96	89.76	0.96	89.76	0.87	81.35
Sand	305.9	Cu. yd.	0.69	211.07	0.69	211.07	0.69	211.07	0.73	223.31	0.72	220.25
Stone, crushed	121.0	Cu. yd.	0.69	83.49	0.69	83.49	0.69	83.49	0.73	88.33	0.72	87.12
Cinders	1,021.3	Cu. yd.	0.44	449.37	0.45	459.59	0.43	439.16	0.42	428.95	0.41	418.73
Brick, common	508.1	M. brk.	7.09	3,602.43	6.24	3,170.54	6.30	3,201.03	6.36	3,231.52	5.52	2,804.71
Blue stone	334.0	Cu. ft.	0.68	227.12	0.68	227.12	0.68	227.12	0.68	227.12	0.68	227.12
Framing, simple	48.2	M.B.M.	20.62	993.88	19.31	930.74	18.19	876.76	17.82	858.92	17.46	841.57
Framing, truss	31.5	M.B.M.	31.12	980.28	28.23	889.25	26.54	836.01	25.91	816.17	24.89	784.04
Roof sheathing	29.9	M.B.M.	18.86	563.91	17.66	528.03	16.63	497.24	16.30	487.37	15.96	477.20
Slaters' felt	255.5	Sqr.	0.95	242.73	0.68	173.74	0.57	145.64	0.54	137.97	0.52	132.86
Slate	255.5	Sqr.	5.09	1,300.50	5.07	1,295.39	5.16	1,318.38	5.28	1,349.04	4.99	1,274.95
Sheathing, exterior	0.2	M.B.M.	26.05	5.21	23.61	4.72	24.07	4.81	24.50	4.90	24.39	4.88
Sheathing, interior	1.9	M.B.M.	26.95	51.21	25.79	49.00	24.44	46.44	24.19	45.96	22.58	42.90
Windows	2,209.0	Sq. ft.	0.24	530.16	0.22	485.98	0.22	485.98	0.22	485.98	0.19	419.71
Doors, engine house	1,366.0	Sq. ft.	0.28	382.48	0.27	368.82	0.27	368.82	0.27	368.82	0.26	355.16
Mouldings, 5 in. and over	9.55	C.L.F.	2.45	23.40	2.23	21.30	2.23	21.30	2.19	20.91	1.87	17.86
Mouldings, under 5 in.	9.55	C.L.F.	0.99	9.45	0.90	8.60	0.90	8.60	0.88	8.40	0.76	7.26
Nails	33.1	Kegs	2.97	98.31	2.47	81.76	2.19	72.49	1.99	65.87	1.65	54.62
Cast iron	14,080.0	Lb.	0.030	422.40	0.028	394.24	0.026	366.08	0.026	366.08	0.022	309.76
Wrought iron	75.33	Cwt.	2.99	225.24	2.87	216.20	2.84	213.94	2.67	201.13	2.25	169.49
Flashing, G.I.	29.05	Sqr.	7.21	209.45	6.76	196.38	6.56	190.57	6.38	185.34	5.63	163.55
Leaders, G.I.	2.20	C.L.F.	8.62	18.96	8.20	18.04	8.02	17.64	7.82	17.20	7.06	15.53
Paint, lead and oil	63.98	Gal.	1.20	76.78	1.13	72.30	1.09	69.74	1.07	68.46	1.00	63.98
Paint, cold water	11.15	Cwt.	1.78	19.85	1.65	18.40	1.68	18.73	1.68	18.73	1.53	17.06
Total cost of material				$12,413.45		$11,584.86		$11,403.07		$11,593.02		$10,474.37
Common labor	7,429.0	Hr.	$ 0.161	1,196.07	$ 0.163	1,210.93	$ 0.163	1,210.93	$ 0.162	1,203.50	$ 0.162	1,203.50
Brick layers	4,387.0	Hr.	0.443	1,943.44	0.451	1,978.54	0.452	1,982.92	0.447	1,960.98	0.448	1,965.38
Hod carriers	4,387.0	Hr.	0.240	1,052.88	0.241	1,057.27	0.244	1,070.43	0.242	1,061.65	0.244	1,070.43
Cement finisher	192.0	Hr.	0.357	68.54	0.354	67.97	0.352	67.58	0.351	67.39	0.337	64.70
Carpenters	3,968.0	Hr.	0.292	1,158.66	0.298	1,182.46	0.302	1,193.34	0.308	1,222.14	0.303	1,202.30
Roofers, slate	815.0	Hr.	0.322	262.43	0.319	259.99	0.320	260.81	0.321	261.62	0.314	255.91
Sheet metal workers	233.0	Hr.	0.286	66.64	0.297	69.20	0.298	69.43	0.298	69.43	0.297	69.20
Painters	348.0	Hr.	0.285	99.18	0.287	99.88	0.291	101.27	0.296	103.01	0.294	102.31
Total cost of labor				$ 5,847.84		$ 5,926.24		$ 5,961.71		$5,949.72		$ 5,933.73
Grand total				$18,261.29		$17,511.10		$17,364.78		$17,542.74		$16,408.10
Per cent of 1914 cost				81.13		77.80		77.13		77.94		72.90
Reciprocal				1.232		1.285		1.296		1.283		1.372

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1895		1896		1897		1898		1899	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	730.4	Bbl.	$ 1.69	$ 1,234.38	$ 1.73	$ 1,263.59	$ 1.69	$ 1,234.38	$ 1.72	$ 1,256.29	$ 1.77	$ 1,292.81
Lime (300 lb. bbl.)	93.5	Bbl.	0.81	75.74	0.72	67.32	0.75	70.13	0.77	72.00	0.82	76.67
Sand	305.9	Cu. yd.	0.73	223.31	0.73	223.31	0.74	226.37	0.80	244.72	0.80	244.72
Stone, crushed	121.0	Cu. yd.	0.73	88.33	0.73	88.33	0.74	89.54	0.80	96.80	0.80	96.80
Cinders	1,021.3	Cu. yd.	0.40	408.53	0.40	408.53	0.38	388.09	0.37	377.88	0.35	357.46
Brick, common	508.1	M. brk.	5.83	2,962.22	5.59	2,840.28	5.47	2,779.31	6.28	3,190.87	6.21	3,155.30
Blue stone	334.0	Cu. ft.	0.68	227.12	0.73	243.82	0.73	243.82	0.73	243.82	0.73	243.82
Framing, simple	48.2	M.B.M.	16.46	793.37	17.22	830.00	16.93	816.03	16.91	815.06	19.71	950.02
Framing, truss	31.5	M.B.M.	22.96	723.24	24.89	784.04	24.19	761.99	24.56	773.64	28.41	894.91
Roof sheathing	29.9	M.B.M.	15.05	450.00	15.75	470.93	15.48	462.85	15.46	462.25	18.02	538.80
Slater's felt	255.5	Sqr.	0.53	135.42	0.55	140.53	0.53	135.42	0.52	132.86	0.90	229.95
Slate	255.5	Sqr.	5.01	1,280.06	4.85	1,239.18	4.69	1,198.30	5.35	1,366.93	4.70	1,200.85
Sheathing, exterior	0.2	M.B.M.	21.77	4.35	20.85	4.17	20.82	4.16	20.71	4.14	23.72	4.74
Sheathing, interior	1.9	M.B.M.	19.91	37.83	18.21	34.60	17.12	32.52	17.06	32.41	24.19	45.96
Windows	2,209.0	Sq. ft.	0.17	375.53	0.16	353.44	0.16	353.44	0.18	397.62	0.23	508.07
Doors, engine house	1,366.0	Sq. ft.	0.25	341.50	0.25	341.50	0.24	327.84	0.24	327.84	0.28	382.48
Mouldings, 5 in. and over	9.55	C.L.F.	1.63	15.57	1.50	14.33	1.45	13.85	1.65	15.76	2.30	21.97
Mouldings, under 5 in.	9.55	C.L.F.	0.66	6.30	0.60	5.73	0.59	5.63	0.67	6.40	0.93	8.88
Nails	33.1	Kegs	2.12	70.17	2.93	96.98	1.49	49.32	1.44	47.66	2.39	79.11
Cast iron	14,080.0	Lb.	0.022	309.76	0.021	295.68	0.019	267.52	0.019	267.52	0.025	352.00
Wrought iron	75.33	Cwt.	2.39	180.04	2.36	177.78	2.33	175.52	2.32	174.77	3.13	235.78
Flashing, G.I.	29.05	Sq.	5.83	169.36	5.53	160.65	5.23	151.93	5.16	149.90	6.95	201.90
Leaders, G.I.	2.20	C.L.F.	7.27	15.99	7.00	15.40	6.72	14.78	6.65	14.63	8.50	18.70
Paint, lead and oil	63.98	Gal.	1.01	64.62	0.91	58.22	0.91	58.22	0.95	60.78	1.01	64.62
Paint, cold water	11.15	Cwt.	1.41	15.72	1.26	14.05	1.30	14.50	1.35	15.05	1.44	16.06
Total cost of material				$10,208.46		$10,172.38		$ 9,875.46		$10,547.54		$11,222.38
Common labor	7,429.0	Hr.	$ 0.160	1,188.64	$ 0.161	1,196.07	$ 0.162	1,203.50	$ 0.163	1,210.93	$ 0.162	1,203.50
Brick layers	4,387.0	Hr.	0.449	1,969.76	0.450	1,974.15	0.443	1,943.44	0.437	1,917.12	0.461	2,022.41
Hod carriers	4,387.0	Hr.	0.241	1,057.27	0.244	1,070.43	0.241	1,057.27	0.244	1,070.43	0.250	1,096.75
Cement finisher	192.0	Hr.	0.337	64.70	0.350	67.20	0.351	67.39	0.351	67.39	0.358	68.74
Carpenters	3,968.0	Hr.	0.295	1,170.56	0.297	1,178.50	0.296	1,174.53	0.307	1,218.18	0.315	1,249.92
Roofers, slate	815.0	Hr.	0.320	260.80	0.319	259.99	0.320	260.80	0.327	266.51	0.330	268.95
Sheet metal workers	233.0	Hr.	0.300	69.90	0.308	71.76	0.314	73.16	0.311	72.46	0.321	74.79
Painters	348.0	Hr.	0.292	101.62	0.294	102.31	0.294	102.31	0.297	103.35	0.305	105.14
Total cost of labor				$ 5,883.25		$ 5,920.41		$ 5,882.40		$ 5,926.38		$ 6,091.20
Grand total				$16,091.71		$16,092.80		$15,757.86		$16,473.92		$17,313.58
Per cent of 1914 cost				71.50		71.50		70.01		73.19		76.92
Reciprocal				1.399		1.399		1.428		1.366		1.300

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1900		1901		1902		1903		1904	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	730.4	Bbl.	$ 1.89	$ 1,380.46	$ 1.62	$ 1,183.25	$ 1.68	$ 1,227.07	$ 1.76	$ 1,285.50	$ 1.19	$ 869.18
Lime (300 lb. bbl.)	93.5	Bbl.	0.71	66.39	0.80	74.80	0.84	78.54	0.82	76.67	0.86	80.41
Sand	305.9	Cu. yd.	0.82	250.84	0.85	260.02	0.88	269.19	0.88	269.19	0.89	272.25
Stone, crushed	121.0	Cu. yd.	0.82	99.22	0.85	102.85	0.88	106.48	0.88	106.48	0.89	107.69
Cinders	1,021.3	Cu. yd.	0.41	418.73	0.43	439.16	0.43	439.16	0.44	449.37	0.44	449.37
Brick, common	508.1	M. brk.	5.80	2,946.98	6.34	3,221.35	5.99	3,043.52	6.53	3,317.90	8.13	4,130.85
Blue stone	334.0	Cu. ft.	0.88	293.92	0.88	293.92	0.88	293.92	0.88	293.92	0.88	293.92
Framing, simple	48.2	M.B.M.	22.38	1,078.72	19.65	947.13	20.78	1,001.60	21.69	1,045.46	22.01	1,060.88
Framing, truss	31.5	M.B.M.	30.97	975.56	26.79	843.89	28.35	893.03	29.23	920.75	29.74	936.81
Roof sheathing	29.9	M.B.M.	20.46	611.75	17.97	537.30	19.00	568.10	19.84	593.22	20.13	601.89
Slater's felt	255.5	Sqr.	0.99	252.95	0.57	145.64	0.54	137.97	0.68	173.74	0.63	160.97
Slate	255.5	Sqr.	4.48	1,144.64	4.65	1,188.08	4.98	1,272.39	5.60	1,430.80	5.46	1,395.03
Sheathing, exterior	0.2	M.B.M.	26.83	5.37	26.51	5.30	28.67	5.73	29.95	5.99	31.01	6.20
Sheathing, interior	1.9	M.B.M.	24.78	47.08	24.54	46.63	25.25	47.98	25.21	47.90	25.21	47.90
Windows	2,209.0	Sq. ft.	0.27	596.43	0.33	728.97	0.35	773.15	0.29	640.61	0.29	640.61
Doors, engine house	1,366.0	Sq. ft	0.31	423.46	0.32	437.12	0.35	478.10	0.36	491.76	0.36	491.76
Mouldings, 5 in and over	9.55	C.L.F.	2.84	27.12	3.37	32.18	3.78	36.10	3.08	29.41	3.02	28.84
Mouldings, under 5 in	9.55	C.L.F.	1.14	10.89	1.36	12.99	1.53	14.61	1.24	11.84	1.22	11.65
Nails	33.10	Kegs	2.63	87.05	2.37	78.45	2.10	69.51	2.08	68.85	1.91	63.22
Cast iron	14,080.0	Lb.	0.029	408.32	0.028	394.24	0.033	464.64	0.035	492.80	0.029	408.32
Wrought iron	75.33	Cwt.	3.14	236.53	3.22	242.56	3.67	276.46	3.61	271.94	3.48	262.15
Flashing, G.I.	29.05	Sqr.	7.18	208.58	7.65	222.23	6.95	201.90	6.22	180.69	5.50	159.78
Leaders, G.I.	2.20	C.L.F.	8.84	19.45	9.37	20.61	8.76	19.27	8.14	17.91	7.39	16.26
Paint, lead and oil	63.98	Gal.	1.21	77.42	1.15	73.58	1.09	69.74	1.09	69.74	1.06	67.82
Paint, cold water	11.15	Cwt.	1.24	13.83	1.41	15.72	1.46	16.28	1.42	15.83	1.50	16.73
Total cost of material				$11,681.69		$11,547.97		$11,804.44		$12,307.27		$12,580.49
Common labor	7,429.0	Hr.	$ 0.170	1,262.93	$ 0.178	1,322.36	$ 0.187	1,389.22	$ 0.192	1,426.37	$ 0.195	1,448.66
Brick layers	4,387.0	Hr.	0.473	2,075.05	0.509	2,232.98	0.543	2,382.14	0.564	2,474.27	0.568	2,491.82
Hod carriers	4,387.0	Hr.	0.260	1,140.62	0.264	1,158.17	0.279	1,223.97	0.295	1,294.17	0.293	1,285.39
Cement finisher	192.0	Hr.	0.366	70.27	0.386	74.11	0.420	80.64	0.445	85.44	0.471	90.43
Carpenters	3,968.0	Hr.	0.348	1,380.86	0.361	1,432.45	0.389	1,543.55	0.414	1,642.75	0.406	1,611.01
Roofers, slate	815.0	Hr.	0.356	290.14	0.370	301.55	0.390	317.85	0.422	343.93	0.390	317.85
Sheet metal workers	233.0	Hr.	0.342	79.69	0.353	82.25	0.376	87.61	0.403	93.90	0.406	94.60
Painters	348.0	Hr.	0.318	110.66	0.328	114.14	0.347	120.76	0.366	127.37	0.378	131.54
Total cost of labor				$ 6,410.22		$ 6,718.01		$ 7,145.74		$ 7,488.20		$ 7,471.30
Grand total				$18,091.91		$18,265 98		$18,950.18		$19,795 47		$20,051.79
Per cent of 1914 cost				80.38		81.16		84.20		87.95		89.09
Reciprocal				1.244		1.232		1.188		1.137		1.122

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1905		1906		1907		1908		1909	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	730.4	Bbl.	$ 1.16	$ 847.26	$ 1.38	$ 1,007.95	$ 1.46	$ 1,066.38	$ 1.27	$ 927.61	$ 1.23	$ 898.39
Lime (300 lb. bbl.)	93.5	Bbl.	0.92	86.02	0.98	91.63	0.99	92.57	1.08	100.98	1.08	100.98
Sand	305.9	Cu. yd.	0.89	272.25	0.95	290.61	0.99	302.84	1.09	333.43	1.09	333.43
Stone, crushed	121.0	Cu. yd.	0.89	107.69	0.95	114.95	0.99	119.79	1.09	131.89	1.09	131.89
Cinders	1,021.3	Cu. yd.	0.43	439.16	0.44	449.37	0.44	449.37	0.45	459.59	0.46	469.80
Brick, common	508.1	M. brk.	8.73	4,435.72	9.21	4,679.60	6.89	3,500.81	5.84	2,967.30	7.16	3,638.00
Blue stone	334.0	Cu. ft.	0.88	293.92	1.03	344.02	1.04	347.36	1.04	347.36	1.19	397.46
Framing, simple	48.2	M.B.M.	23.13	1,114.87	29.13	1,404.07	29.44	1,419.00	26.59	1,281.64	25.23	1,216.09
Framing, truss	31.5	M.B.M.	31.34	987.21	40.10	1,263.15	40.43	1,273.55	35.52	1,118.88	32.78	1,032.57
Roof sheathing	29.9	M.B.M.	21.15	632.39	26.63	796.24	26.92	804.91	24.31	726.87	23.07	689.79
Slater's felt	255.5	Sqr.	0.57	145.64	0.56	143.08	0.57	145.64	0.57	145.64	0.55	140.53
Slate	255.5	Sqr.	5.27	1,346.48	5.28	1,349.04	5.49	1,402.70	5.43	1,387.37	5.35	1,366.93
Sheathing, exterior	0.2	M.B.M.	32.82	6.56	37.77	7.55	38.73	7.75	39.68	7.94	35.72	7.14
Sheathing, interior	1.9	M.B.M.	26.21	49.80	31.54	59.93	32.18	61.14	32.25	61.28	31.99	60.78
Windows	2,209.0	Sq. ft.	0.31	684.79	0.31	684.79	0.33	728.97	0.31	684.79	0.31	684.79
Doors, engine house	1,366.0	Sq. ft.	0.38	519.08	0.41	560.06	0.42	573.72	0.42	573.72	0.41	560.06
Mouldings, 5 in. and over	9.55	C.L.F.	3.19	30.46	3.00	28.65	3.27	31.23	3.14	29.99	3.20	30.56
Mouldings, under 5 in.	9.55	C.L.F.	1.29	12.32	1.21	11.56	1.32	12.61	1.27	12.13	1.29	12.32
Nails	33.1	Kegs	1.90	62.89	1.96	64.88	2.12	70.17	2.10	69.51	1.92	63.55
Cast iron	14,080.0	Lb.	0.033	464.64	0.038	535.04	0.039	549.12	0.031	436.48	0.031	436.48
Wrought iron	75.33	Cwt.	3.74	281.73	3.78	284.75	3.97	299.06	3.63	273.45	3.73	280.98
Flashing, G.I.	29.05	Sqr.	5.73	166.46	5.98	173.72	6.32	183.60	6.03	175.17	5.72	166.17
Leaders, G.I.	2.20	C.L.F.	7.71	16.96	7.98	17.56	8.32	18.30	8.08	17.78	7.81	17.18
Paint, lead and oil	63.98	Gal.	1.14	72.94	1.18	75.50	1.20	76.78	1.14	72.94	1.22	78.06
Paint, cold water	11.15	Cwt.	1.61	17.95	1.72	19.18	1.72	19.18	1.89	21.07	1.89	21.07
Total cost of material				$13,095.19		$14,456.88		$13,556.55		$12,364.81		$12,835.00
Common labor	7,429.0	Hr.	$ 0.193	1,433.80	$ 0.203	1,508.09	$ 0.226	1,678.95	$ 0.228	1,693.81	$ 0.239	1,775.53
Brick layers	4,387.0	Hr.	0.594	2,605.88	0.604	2,649.75	0.607	2,662.91	0.612	2,684.84	0.616	2,702.39
Hod carriers	4,387.0	Hr.	0.296	1,298.55	0.304	1,333.65	0.316	1,386.29	0.319	1,399.45	0.323	1,417.00
Cement finisher	192.0	Hr.	0.476	91.39	0.490	94.08	0.550	105.60	0.551	105.79	0.555	106.56
Carpenters	3,968.0	Hr.	0.426	1,690.37	0.441	1,749.89	0.465	1,845.12	0.466	1,849.09	0.476	1,888.77
Roofers, slate	815.0	Hr.	0.386	314.59	0.397	323.56	0.402	327.63	0.428	348.82	0.454	370.01
Sheet metal workers	233.0	Hr.	0.418	97.39	0.425	99.03	0.424	98.79	0.434	101.12	0.445	103.69
Painters	348.0	Hr.	0.388	135.02	0.398	138.50	0.414	144.07	0.420	146.16	0.425	147.90
Total cost of labor				$ 7,666.99		$ 7,896.55		$ 8,249.36		$ 8,329.08		$ 8,511.85
Grand total				$20,762.18		$22,353.43		$21,805.91		$20,693.89		$21,346.85
Per cent of 1914 cost				92.25		99.32		96.88		91.94		94.84
Reciprocal				1.084		1.007		1.032		1.088		1.054

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1910		1911		1912		1913		1914	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	730.4	Bbl.	$ 1.26	$ 920.30	$ 1.20	$ 876.48	$ 1.06	$ 774.22	$ 1.32	$ 964.13	$ 1.32	$ 964.12
Lime (300 lb. bbl.)	93.5	Bbl.	1.08	100.98	1.15	107.53	1.13	105.66	1.12	104.72	1.07	100.05
Sand	305.9	Cu. yd.	1.16	354.84	1.16	354.84	1.22	373.20	1.24	379.32	1.25	382.38
Stone, crushed	121.0	Cu. yd.	1.16	140.36	1.16	140.36	1.22	147.62	1.24	150.04	1.25	151.25
Cinders	1,021.3	Cu. yd.	0.47	480.01	0.47	480.01	0.48	490.22	0.48	490.22	0.48	490.22
Brick, common	508.1	M. brk.	6.51	3,307.73	6.70	3,404.27	7.60	3,861.56	7.64	3,881.88	7.05	3,582.11
Blue stone	334.0	Cu. ft.	1.19	397.46	1.19	397.46	1.19	397.46	1.19	397.46	1.20	400.80
Framing, simple	48.2	M.B.M.	25.67	1,237.29	26.20	1,262.84	27.16	1,309.11	28.03	1,351.05	26.17	1,261.39
Framing, truss	31.5	M.B.M.	33.56	1,057.14	34.56	1,088.64	35.64	1,122.66	34.77	1,095.26	30.13	949.10
Roof sheathing	29.9	M.B.M.	23.48	702.05	23.95	716.11	24.84	742.72	25.63	766.34	23.93	715.51
Slaters' felt	255.5	Sqr.	0.52	132.86	0.52	132.86	0.52	132.86	0.52	132.86	0.52	132.86
Slate	255.5	Sqr.	5.33	1,361.82	5.28	1,349.04	5.23	1,336.27	5.59	1,428.25	5.78	1,476.79
Sheathing, exterior	0.2	M.B.M.	35.79	7.16	35.72	7.14	35.61	7.12	36.92	7.38	35.40	7.08
Sheathing, interior	1.9	M.B.M.	31.80	60.42	31.12	59.13	31.73	60.29	33.92	64.45	32.12	61.03
Windows	2,209.0	Sq. ft.	0.31	684.79	0.28	618.52	0.27	596.43	0.29	640.61	0.29	640.61
Doors, engine house	1,366.0	Sq. ft.	0.41	560.06	0.41	560.06	0.42	573.72	0.44	601.04	0.44	601.04
Mouldings, 5 in. and over	9.55	C.L.F.	3.02	28.84	2.89	27.60	2.73	26.07	2.84	27.12	2.80	26.74
Mouldings, under 5 in	9.55	C.L.F.	1.22	11.65	1.17	11.17	1.10	10.51	1.14	10.89	1.13	10.79
Nails	33.1	Kegs	1.89	62.56	1.80	59.59	1.74	57.59	1.82	60.24	1.68	55.61
Cast iron	14,080.0	Lb.	0.029	408.32	0.026	366.09	0.027	380.16	0.028	394.24	0.025	352.00
Wrought iron	75.33	Cwt.	3.83	288.51	3.64	274.20	3.85	290.02	4.17	314.13	4.00	301.32
Flashing, G.I	29.05	Sqr.	5.79	168.20	5.28	153.38	5.33	154.84	5.71	165.88	5.09	147.86
Leaders, G.I	2.20	C.L.F.	7.97	17.53	7.47	16.43	7.58	16.68	8.07	17.75	7.53	16.57
Paint, lead and oil	63.98	Gal.	1.45	92.77	1.50	95.97	1.33	85.09	1.20	76.78	1.23	78.70
Paint, cold water	11.15	Cwt.	1.89	21.07	2.00	22.30	1.96	21.85	1.94	21.63	1.85	20.63
Total cost of material				$12,604.72		$12,582.02		$13,073.93		$13,543.67		$12,926.56
Common labor	7,429.0	Hr.	$ 0.244	1,812.68	$ 0.248	1,842.39	$ 0.259	1,924.11	$ 0.263	1,953.83	$ 0.280	2,080.12
Brick layers	4,387.0	Hr.	0.629	2,759.42	0.629	2,759.42	0.636	2,790.13	0.659	2,891.03	0.674	2,956.84
Hod carriers	4,387.0	Hr.	0.332	1,456.48	0.336	1,474.03	0.340	1,491.58	0.345	1,513.52	0.350	1,535.45
Cement finisher	192.0	Hr.	0.564	108.29	0.566	108.67	0.570	109.44	0.592	113.66	0.620	119.04
Carpenters	3,968.0	Hr.	0.495	1,964.16	0.500	1,984.00	0.509	2,019.71	0.522	2,071.30	0.538	2,134.78
Roofers, slate	815.0	Hr.	0.454	370.01	0.470	383.05	0.483	393.65	0.509	414.84	0.561	457.22
Sheet metal workers	233.0	Hr.	0.462	107.65	0.467	108.81	0.481	112.07	0.506	117.90	0.527	122.79
Painters	348.0	Hr.	0.442	153.82	0.458	159.38	0.468	162.86	0.486	169.13	0.502	174.70
Total cost of labor				$ 8,732.51		$ 8,819.75		$ 9,003.55		$ 9,245.21		$9,580.94
Grand total				$21,337.23		$21,401.77		$22,077.48		$22,788.88		$22,507.50
Per cent of 1914 cost				94.80		95.09		98.09		101.25		100.00
Reciprocal				1.055		1.052		1.019		0.988		1.000

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH WOODEN ROOF TRUSSES.—*(Continued)*

Item	Quantity	Unit	1915		1916		1917		1918		1919	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	730.4	Bbl.	$ 1.19	$ 869.18	$ 1.44	$ 1,051.78	$ 1.85	$ 1,351.24	$ 2.27	$ 1,658.01	$ 2.73	$ 1,993.99
Lime (300 lb. bbl.)	93.5	Bbl.	1.28	119.68	1.45	135.58	1.82	170.17	2.38	222.53	2.76	258.06
Sand	305.9	Cu. yd.	1.27	388.49	1.35	412.97	1.56	477.20	1.87	572.03	2.01	614.86
Stone, crushed	121.0	Cu. yd.	1.27	153.67	1.35	163.35	1.56	188.76	1.87	226.27	2.01	243.21
Cinders	1,021.3	Cu. yd.	0.50	510.65	0.51	520.86	0.55	561.72	0.69	704.70	0.75	765.98
Brick, common	508.1	M. brk.	7.05	3,582.11	8.41	4,273.12	9.83	4,994.62	13.95	7,088.00	16.23	8,246.46
Blue stone	334.0	Cu. ft.	1.20	400.80	1.30	434.20	1.31	437.54	1.33	444.22	1.74	581.16
Framing, simple	48.2	M.B.M.	24.97	1,203.55	29.47	1,420.45	36.53	1,760.75	44.91	2,164.66	54.64	2,633.65
Framing, truss	31.5	M.B.M.	29.98	944.37	38.17	1,202.36	49.53	1,560.20	63.45	1,998.68	71.56	2,254.14
Roof sheathing	29.9	M.B.M.	22.83	682.62	26.95	805.81	33.41	998.96	41.06	1,227.69	49.97	1,494.11
Slaters' felt	255.5	Sqr.	0.52	132.86	0.70	178.86	0.79	201.85	0.92	235.06	0.96	245.28
Slate	255.5	Sqr.	5.50	1,405.25	5.69	1,453.80	6.73	1,719.52	8.12	2,074.66	8.96	2,289.28
Sheathing, exterior	0.2	M.B.M.	34.62	6.92	33.88	6.78	45.03	9.01	53.56	10.71	63.08	12.62
Sheathing, interior	1.9	M.B.M.	30.03	57.06	32.57	61.88	38.67	73.47	37.47	71.19	55.25	104.97
Windows	2,209.0	Sq. ft.	0.29	640.61	0.32	706.88	0.39	861.51	0.51	1,126.59	0.63	1,391.67
Doors, engine house	1,366.0	Sq. ft.	0.44	601.04	0.49	669.34	0.60	819.60	0.67	915.22	0.73	997.18
Mouldings, 5 in. and over	9.55	C.L.F.	2.74	26.17	2.80	26.74	3.15	30.08	4.07	38.87	5.55	53.00
Mouldings, under 5 in	9.55	C.L.F.	1.11	10.60	1.13	10.79	1.27	12.13	1.64	15.66	2.24	21.39
Nails	33.1	Kegs	1.75	57.93	2.60	86.06	3.63	120.15	3.60	119.16	3.52	116.51
Cast iron	14,080.0	Lb.	0.028	394.24	0.038	535.04	0.066	929.28	0.073	1,027.84	0.069	971.52
Wrought iron	75.33	Cwt.	4.15	312.62	5.73	431.64	7.23	544.64	7.59	571.75	7.15	538.61
Flashing, G.I.	29.05	Sqr.	6.36	184.76	8.05	233.85	12.85	373.29	10.47	304.15	9.87	286.72
Leaders, G.I.	2.20	C.L.F.	8.88	19.54	10.63	23.39	15.61	34.34	13.54	29.79	13.38	29.44
Paint, lead and oil	63.98	Gal.	1.29	82.53	1.68	107.49	2.12	135.64	2.61	166.99	2.82	180.42
Paint, cold water	11.15	Cwt.	2.24	24.98	2.54	28.32	3.18	35.46	4.18	46.61	4.83	53.85
Total cost of material				$12,812.23		$14,981.34		$18,401.13		$23,061.04		$26,378.08
Common labor	7,429.0	Hr.	$ 0.276	2,050.40	$ 0.312	2,317.85	$ 0.361	2,681.87	$ 0.466	3,461.91	$ 0.539	4,004.23
Brick layers	4,387.0	Hr.	0.683	2,996.32	0.691	3,031.42	0.736	3,228.83	0.794	3,483.28	0.904	3,965.85
Hod carriers	4,387.0	Hr.	0.352	1,544.22	0.372	1,631.96	0.421	1,846.93	0.501	2,197.89	0.601	2,636.59
Cement finisher	192.0	Hr.	0.630	120.96	0.636	122.11	0.671	128.83	0.729	139.97	0.823	158.02
Carpenters	3,968.0	Hr.	0.549	2,178.43	0.565	2,241.92	0.621	2,464.13	0.678	2,690.30	0.779	3,091.07
Roofers, slate	815.0	Hr.	0.571	465.37	0.581	473.52	0.619	504.49	0.670	546.05	0.762	621.03
Sheet metal workers	233.0	Hr.	0.536	124.89	0.542	126.29	0.566	131.88	0.649	151.22	0.747	174.05
Painters	348.0	Hr.	0.503	175.04	0.532	185.14	0.562	195.58	0.646	224.81	0.740	257.52
Total cost of labor				$ 9,655.63		$10,130.21		$11,182.54		$12,895.43		$14,908.36
Grand total				$22,467.86		$25,111.55		$29,583.67		$35,956.47		$41,286.44
Per cent of 1914 cost				99.82		111.57		131.44		159.75		183.44
Reciprocal				1.00		0.896		0.761		0.626		0.545

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH WOODEN ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1920		1921		1922		1923	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	730.4	Bbl.	$ 3.44	$ 2,512.58	$ 2.67	$ 1,950.17	$ 2.36	$ 1,723.74	$ 2.50	$ 1,826.00
Lime (300 lb. bbl.)	93.5	Bbl.	3.78	353.43	3.92	366.52	3.94	368.39	4.01	374.94
Sand	305.9	Cu. yd.	3.01	920.76	2.62	801.46	2.22	679.10	2.77	847.34
Stone, crushed	121.0	Cu. yd.	3.01	364.21	2.62	317.02	2.22	268.62	2.77	335.17
Cinders	1,021.3	Cu. yd.	0.98	1,000.87	0.98	1,000.87	0.87	888.44	0.90	919.08
Brick, common	508.1	M. brk.	25.06	12,732.99	20.32	10,324.59	18.34	9,318.55	21.27	10,807.29
Blue stone	334.0	Cu. ft.	1.86	621.24	1.86	621.24	1.73	577.82	1.85	617.90
Framing, simple	48.2	M B.M.	64.64	3,115.65	50.06	2,412.89	50.06	2,412.89	54.25	2,614.85
Framing, truss	31.5	M B.M.	81.23	2,558.75	63.60	2,003.40	69.15	2,178.23	78.82	2,482.83
Roof sheathing	29.9	M B M.	59.11	1,767.39	45.78	1,368.82	45.78	1,368.82	49.61	1,483.34
Slaters' felt	255.5	Sqr.	1.54	393.47	1.80	459.90	1.81	462.46	1.80	459.90
Slate	255.5	Sqr.	11.62	2,968.91	11.39	2,910.15	10.76	2,749.18	10.94	2,795.17
Sheathing, exterior	0.2	M B M.	113.95	22.79	72.99	14.60	83.90	16.78	90.59	18.12
Sheathing, interior	1.9	M.B M.	105.26	199.99	66.10	125.59	66.84	127.00	77.73	147.69
Windows	2,209.0	Sq. ft.	0.89	1,966.01	0.63	1,391.67	0.64	1,413.76	0.76	1,678.84
Doors, engine house	1,366.0	Sq. ft.	1.08	1,475.28	0.86	1,174.76	0.85	1,161.10	0.94	1,284.04
Mouldings, 5 in. and over	9.55	C.L F.	8.92	85.19	5.71	54.53	6.69	63.89	7.99	76.30
Mouldings, under 5 in	9.55	C.L F.	3.60	34.38	2.30	21.97	2.70	25.79	3.23	30.85
Nails	33.1	Kegs	4.20	139.02	3.07	101.62	2.53	83.74	2.92	96.65
Cast iron	14,080.0	Lb.	0.089	1,253.12	0.066	929.28	0.055	774.40	0.072	1,013.76
Wrought iron	75.33	Cwt.	9.03	680.23	7.23	544.64	6.48	488.14	7.57	570.25
Flashing, G.I.	29.05	Sqr.	12.41	360.51	8.64	250.99	7.75	225.14	8.65	251.28
Leaders, G.I.	2.20	C L.F.	17.00	37.40	13.24	29.13	11.93	26.25	13.45	29.59
Paint, lead and oil	63.98	Gal.	3.02	193.22	2.20	140.76	2.19	140.12	2.26	144.59
Paint, cold water	11.15	Cwt.	6.63	73.92	6.88	76.71	6.97	77.72	7.07	78.83
Total cost of material				$35,831.31		$29,393.28		$27,620.07		$30,984.60
Common labor	7,429.0	Hr.	$ 0.697	5,178.01	$ 0.687	5,103.72	$ 0.503	3,736.79	$ 0.631	4,687.70
Brick layers	4,387.0	Hr.	1.166	5,115.24	1.227	5,382.85	1.167	5,119.63	1.325	5,812.78
Hod carriers	4,387.0	Hr.	0.786	3,448.18	0.802	3,518.37	0.672	2,948.06	0.845	3,707.02
Cement finisher	192.0	Hr.	1.091	209.47	1.154	221.57	1.024	196.61	1.156	221.95
Carpenters	3,968.0	Hr.	1.027	4,075.14	1.068	4,237.82	0.958	3,801.34	1.087	4,313.22
Roofers, slate	815.0	Hr.	1.014	826.41	1.082	881.83	0.994	810.11	1.107	902.21
Sheet metal workers	233.0	Hr.	0.975	227.18	1.030	239.99	0.924	215.29	1.067	248.61
Painters	348.0	Hr.	1.000	348.00	1.034	359.83	0.918	319.46	1.033	359.48
Total cost of labor				$19,427.63		$19,945.98		$17,147.29		$20,252.97
Grand total				$55,258.94		$49,339.26		$44,767.36		$51,237.57
Per cent of 1914 cost				245.52		219.21		198.90		227.65
Reciprocal				0.407		0.456		0.503		0.439

Estimated Average Cost of a Typical Brick Shop Building with Steel Roof Trusses

Item	Quantity	Unit	1890		1891		1892		1893		1894	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	314.3	Bbl.	$ 2.18	$ 685.17	$ 2.18	$ 685.17	$ 2.18	$ 685.17	$ 2.46	$ 773.18	$ 2.03	$ 638.03
Lime (300 lb. bbl.)	36.8	Bbl.	1.00	36.80	0.94	34.59	0.96	35.33	0.96	35.33	0.87	32.02
Sand	134.9	Cu. yd.	0.69	93.08	0.69	93.08	0.69	93.08	0.73	98.48	0.72	97.13
Stone, crushed	84.9	Cu. yd.	0.69	58.58	0.69	58.58	0.69	58.58	0.73	61.98	0.72	61.13
Cinders	458.8	Cu. yd.	0.44	201.87	0.45	206.46	0.43	197.28	0.42	192.70	0.41	188.11
Brick, common	201.256	M. brk.	7.09	1,426.91	6.24	1,255.84	6.30	1,267.91	6.36	1,279.99	5.52	1,110.93
Granite, tooled	278.9	Cu. ft.	1.82	507.60	1.82	507.60	1.82	507.60	1.82	507.60	1.82	507.60
Terra cotta coping	61.5	Cu. ft.	0.68	41.82	0.68	41.82	0.68	41.82	0.68	41.82	0.68	41.82
Structural steel	1,567.16	Cwt.	3.09	4,842.52	2.80	4,388.05	2.64	4,137.30	2.45	3,839.54	2.13	3,338.05
Light steel roof trusses	208.10	Cwt.	4.72	982.23	4.44	923.96	4.18	869.86	3.93	817.83	3.42	711.70
Roof sheathing	24.449	M.B.M.	18.86	461.11	17.66	431.77	16.63	406.59	16.30	398.52	15.96	390.21
Roofing, 5 ply-pitch and gravel	100.25	Sqr.	4.48	449.12	4.48	449.12	4.48	449.12	4.48	449.12	4.48	449.12
Framing, simple	13.133	M.B.M.	20.62	270.80	19.31	253.60	18.19	238.89	17.82	234.03	17.46	229.30
Y.P. dressed (flooring for shops)	36.259	M.B.M.	31.43	1,139.62	28.51	1,033.74	26.81	872.10	26.17	948.90	25.14	911.55
2-ply building paper	61.93	Sqr.	0.95	58.83	0.68	42.11	0.57	35.30	0.54	33.44	0.52	32.20
Windows	5,860.0	Sq. ft.	0.24	1,406.40	0.22	1,289.20	0.22	1,289.20	0.22	1,289.20	0.19	1,113.40
Doors, engine house	937.0	Sq. ft.	0.28	262.36	0.27	252.99	0.27	252.99	0.27	252.99	0.26	243.62
Mouldings, under 5 in	37.50	C.L.F.	0.99	37.13	0.90	33.75	0.90	33.75	0.88	33.00	0.76	28.50
Nails	20.8	Kegs	2.97	61.78	2.47	51.38	2.19	45.55	1.99	41.39	1.65	34.32
Cast iron	390.0	Lb.	0.030	11.70	0.028	10.92	0.026	10.14	0.026	10.14	0.022	8.58
Wrought iron	14.23	Cwt.	2.99	42.55	2.87	40.84	2.84	40.41	2.67	37.99	2.25	32.02
Miscellaneous iron	126.45	Cwt.	2.99	378.09	2.87	362.91	2.84	359.12	2.67	337.62	2.25	284.51
No. 22 G.I. sheets, interior	705.0	Lb.	0.049	34.55	0.045	31.73	0.044	31.02	0.043	30.32	0.037	26.09
16 oz. copper flashing	8.82	Sqr.	23.14	204.09	19.36	170.76	16.36	144.30	15.36	135.48	14.66	129.30
5 in. copper hanging gutter	2.41	C.L.F.	20.55	49.53	17.46	42.08	14.98	36.10	14.15	34.10	13.56	32.68
Leaders, 3 by 4 in., 16 oz. copper	1.80	C.L.F.	35.83	64.49	30.19	54.34	25.70	46.26	24.20	43.56	23.14	41.65
Paint, cold water	19.324	Cwt.	1.78	34.40	1.65	31.88	1.68	32.47	1.68	32.47	1.53	29.57
Paint, lead and oil	119.6	Gal.	1.20	143.52	1.13	135.15	1.09	130.36	1.07	127.97	1.00	119.60
Total cost of material				$13,986.65		$12,913.42		$12,447.60		$12,118.69		$10,862.74
Common labor	3,411.8	Hr.	$ 0.161	549.30	$ 0.163	556.12	$ 0.163	556.12	$ 0.162	552.71	$ 0.162	552.71
Brick layers	2,131.9	Hr.	0.443	944.43	0.451	961.49	0.452	963.62	0.447	952.96	0.448	955.09
Hod carrier	2,193.1	Hr.	0.240	526.34	0.241	528.54	0.244	535.12	0.242	530.73	0.244	535.12
Carpenter	2,830.1	Hr.	0.292	826.39	0.298	843.37	0.302	854.69	0.308	871.67	0.303	857.52
Roofer	176.4	Hr.	0.223	39.34	0.231	40.75	0.235	41.45	0.233	41.10	0.227	40.04
Sheet metal worker	105.3	Hr.	0.286	30.12	0.297	31.27	0.298	31.38	0.298	31.38	0.297	31.27
Ornamental iron worker	17.6	Hr.	0.243	4.28	0.251	4.42	0.249	4.38	0.250	4.40	0.234	4.12
Painter	811.3	Hr.	0.285	231.22	0.287	232.84	0.291	236.09	0.296	240.14	0.294	238.52
Total cost of labor				$ 3,151.42		$ 3,198.80		$ 3,222.85		$ 3,225.09		$ 3,214.39
Grand total				$17,138.07		$16,112.22		$15,670.45		$15,343.98		$14,077.13
Per cent of 1914 cost				91.2		85.7		83.4		81.6		74.9
Reciprocal				1.097		1.167		1.200		1.225		1.335

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH STEEL ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1895		1896		1897		1898		1899	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	314.3	Bbl.	$ 1.69	$ 531.17	$ 1.73	$ 543.74	$ 1.69	$ 531.17	$ 1.72	$ 540.60	$ 1.77	$ 556.31
Lime (300 lb. bbl.)	36.8	Bbl.	0.81	29.81	0.72	26.50	0.75	27.60	0.77	28.34	0.82	30.18
Sand	134.9	Cu. yd.	0.73	98.48	0.73	98.48	0.74	99 83	0.80	107 92	0.80	107.92
Stone, crushed	84.9	Cu. yd.	0.73	61 98	0.73	61.98	0.74	62 83	0.80	67.92	0.80	67.92
Cinders	458.8	Cu. yd.	0.40	183 52	0.40	183.52	0.38	174 34	0.37	169.76	0.35	160.58
Brick, common	201.256	M. brk.	5.83	1,173.32	5.59	1,125.02	5.47	1,100 87	6.28	1,263.89	6.21	1,249.80
Granite, tooled	278.9	Cu. ft.	1.82	507.60	1.95	543.85	1.95	543.85	1.95	543 85	1.95	543.86
Terra cotta coping	61.5	Cu. ft.	0.68	41.82	0.73	44.90	0.73	44.90	0.73	44.90	0 73	44.90
Structural steel	1,567.16	Cwt.	2.40	3,761.18	2.53	3,964.92	2.21	3,463 42	2.05	3,212.68	3.06	4,795.51
Light steel roof trusses	208.10	Cwt.	3.89	809.51	4.07	846 97	3.60	749 16	3.32	690.89	4.94	1,028.01
Roof sheathing	24.449	M.B.M.	15.05	367.96	15.75	385 07	15.48	378.47	15.46	377.98	18.02	440.57
Roofing, 5 ply-pitch and gravel	100.25	Sqr.	4.48	449.12	4.48	449.12	4 48	449 12	4.48	449.12	4.48	449 12
Framing, simple	13.133	M.B.M.	16.46	216.17	17.22	226.15	16 93	222 34	16.91	222.08	19.71	258.85
Y.P. dressed (flooring for shops)	36.259	M.B.M.	23.19	840.85	25.14	911.55	24.44	886.17	24.80	899.22	28.70	1,040.63
2-ply building paper	61.93	Sqr.	0.53	32.82	0.55	34.06	0.53	32 82	0.52	32.20	0.90	55.74
Windows	5,860.0	Sq. ft.	0.17	996.20	0.16	937.60	0.16	937 60	0.18	1,054.80	0.23	1,347.80
Doors, engine house	937.0	Sq. ft.	0.25	234.25	0.25	234.25	0.24	224.88	0.24	224 88	0.28	262.36
Mouldings, under 5 in.	37.50	C.L.F.	0.66	24.75	0.60	22.50	0.59	22.13	0.67	25.13	0.93	34.88
Nails	20.8	Kegs	2.12	44.10	2.93	60.94	1.49	30.99	1.44	29.95	2.39	49.71
Cast iron	390.0	Lb.	0.022	8.58	0.021	8.19	0.019	7.41	0.019	7.41	0.025	9.75
Wrought iron	14.23	Cwt.	2.39	34.01	2.36	33.58	2.33	33.16	2.32	33.01	3.12	44.40
Miscellaneous iron	126.45	Cwt.	2.39	302.21	2.36	298.42	2.33	294 63	2 32	293.36	3.12	394.52
No. 22 G.I. sheets, interior	705.0	Lb.	0.039	27.50	0.037	26.09	0.034	23.97	0.034	23.97	0.046	32.43
16 oz. copper flashing	8.82	Sqr.	14.66	129.30	14.67	129.39	14.98	132 12	14.37	126.74	22.19	195.72
5 in. copper hanging gutter	2.41	C.L.F.	13.58	32.73	13.62	32.82	13.91	33.52	13.39	32.27	19.92	48.01
Leaders, 3 by 4 in., 16 oz. copper	1.80	C.L.F.	23.16	41.69	23.20	41.76	23.69	42.64	22.77	40 99	34.53	62.15
Paint, cold water	19.324	Cwt.	1.41	27.25	1.26	24.35	1.30	25.12	1.35	26.09	1.44	27.83
Paint, lead and oil	119 6	Gal.	1.01	120.80	0.91	108.84	0.91	108.84	0.95	113 62	1.01	120.80
Total cost of material				$11,128.68		$11,404.56		$10,683.90		$10,683.51		$13,460.26
Common labor	3,411.8	Hr.	$ 0.160	545.89	$ 0.161	549.30	$ 0.162	552.71	$ 0.163	556.12	$ 0.162	552.71
Brick layers	2,131.9	Hr.	0.449	957.22	0.450	959.36	0.443	944.43	0.437	931 64	0.461	982.81
Hod carrier	2,193.1	Hr.	0.241	528.54	0.244	535.12	0.241	528.54	0.244	535.12	0.250	548 28
Carpenter	2,830.1	Hr.	0.295	834.88	0.297	840.54	0.296	837.71	0.307	868.84	0.315	891.48
Roofer	176.4	Hr.	0.224	39.51	0.226	39.87	0.233	41.10	0.232	40.92	0.235	41.44
Sheet metal worker	105.3	Hr.	0.300	31.59	0.308	32.43	0.314	33.06	0.311	32.75	0.321	33.80
Ornamental iron worker	17.6	Hr.	0.246	4.33	0.249	4.38	0.264	4.65	0.268	4.72	0.274	4.82
Painter	811.3	Hr.	0.292	236.90	0.294	238.52	0.294	238.52	0.297	240.96	0.305	247.45
Total cost of labor				$ 3,178.86		$ 3,199.52		$ 3,180.72		$ 3,211.07		$ 3,302.79
Grand total				$14,307.54		$14,604.08		$13,864 62		$13,894.58		$16,763.05
Per cent of 1914 cost				76.1		77.7		73.8		73.9		89.2
Reciprocal				1.314		1.287		1.356		1 353		1.121

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH STEEL ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1900		1901		1902		1903		1904	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	314.3	Bbl.	$ 1.89	$ 594.03	$ 1.62	$ 509.17	$ 1.68	$ 528.02	$ 1.76	$ 553 17	$ 1.19	$ 374 02
Lime (300 lb. bbl.)	36.8	Bbl.	0.71	26.13	0.80	29.44	0.84	30.91	0.82	30.18	0.86	31 65
Sand	134.9	Cu. yd.	0.82	110.62	0.85	114.67	0.88	118.71	0.88	118.71	0.89	120 06
Stone, crushed	84.9	Cu. yd.	0.82	69.62	0.85	72.17	0 88	74.71	0.88	74.71	0.89	75.56
Cinders	458.8	Cu. yd.	0.41	188.10	0.43	197.28	0.43	197.28	0.44	201.87	0.44	201.87
Brick, common	201.256	M. brk.	5.80	1,167.28	6.34	1,275.96	5.99	1,205.52	6.53	1,314.20	8.13	1,636 21
Granite, tooled	278.9	Cu. ft.	1.91	532.70	2.04	568.96	2.20	613.58	2.33	649.84	2.46	686 09
Terra cotta coping	61.5	Cu. ft.	0.88	54.12	0.88	54.12	0.88	54.12	0.88	54.12	0.88	54.12
Structural steel	1,567.16	Cwt.	3.18	4,983.57	2.65	4,152.97	3.09	4,842 52	2.77	4,341.03	2.56	4,011.93
Light steel roof trusses	208.10	Cwt.	5.14	1,069.63	4.29	892 75	4.98	1,036 34	4.46	928.13	4.12	857.37
Roof sheathing	24.449	M.B.M.	20.46	500 23	17.97	439.35	19.00	464.53	19.84	485 07	20.13	492.16
Roofing, 5 ply, pitch and gravel	100.25	Sqr.	4.48	449 12	4.48	449 12	4.48	449 12	4.48	449.12	4.48	449.12
Framing, simple	13.133	M.B.M.	22.38	293.92	19.65	258.07	20.78	272.90	21.69	284 85	22.01	289.06
Y.P. dressed (flooring for shops)	36.259	M.B.M.	31.28	1,134.18	27.05	980.81	28.63	1,038.10	29.52	1,070.37	30.03	1,088.86
2-ply building paper	61.93	Sqr.	0.99	61.31	0.57	35.30	0.54	33.44	0.68	42.11	0.63	39.02
Windows	5,860.0	Sq. ft.	0.27	1,582.20	0.33	1,933.80	0.35	2,051.00	0.29	1,699.40	0.29	1,699.40
Doors, engine house	937.0	Sq. ft.	0.31	290.47	0.32	299.84	0.35	327.95	0.36	337.32	0.36	337.32
Mouldings under 5 in	37.50	C.L.F.	1.14	42.75	1.36	51.00	1.53	57.38	1.24	46.50	1.22	45.75
Nails	20.8	Kegs	2.63	54.70	2.37	49.30	2.10	43.68	2.08	43.26	1.91	39.73
Cast iron	390.0	Lb.	0.029	11.31	0.028	10.92	0.033	12 87	0.035	13.65	0.029	11.31
Wrought iron	14.23	Cwt.	3.14	44.68	3.22	45.82	3.67	52.22	3.61	51.37	3.48	49.52
Miscellaneous iron	126.45	Cwt.	3.14	397.05	3.22	407.17	3.67	464.07	3.61	456.48	3.48	440.05
No. 22 G.I. sheets, interior	705.0	Lb.	0.048	33.84	0.051	35.96	0.046	32 43	0.041	28.91	0.036	25.38
16-oz. copper flashing	8.82	Sqr.	21.11	186.19	21.32	188.04	18.25	160 97	19.68	173.58	18.49	163.08
5 in. copper hanging gutter	2.41	C.L.F.	19.13	46.10	19.36	46.66	16.91	40.75	18.23	43.93	17.25	41.57
Leaders 3 by 4 in., 16 oz. copper	1.80	C.L.F.	33.00	59.40	33.36	60.05	28.84	51.91	31 09	55.96	29.31	52.76
Paint, cold water	19.324	Cwt.	1.24	23.96	1.41	27.25	1.46	28 21	1.42	27.44	1.50	28.99
Paint, lead and oil	119 6	Gal.	1.21	144.72	1.15	137.54	1.09	130 36	1.09	130.36	1.06	126.78
Total cost of material				$14,151.93		$13,323.49		$14,413.60		$13,705.64		$13,468.74
Common labor	3,411.8	Hr.	$ 0.170	580 01	$ 0.178	607.30	$ 0.187	638.01	$ 0.192	655.07	$ 0.195	665.30
Brick layers	2,131.9	Hr.	0.473	1,008.39	0.509	1,085.14	0.543	1,157.62	0.564	1,202.39	0.568	1,210.92
Hod carrier	2,193.1	Hr.	0.260	570.21	0.264	578.98	0.279	611.87	0.295	646.96	0.293	642.58
Carpenter	2,830.1	Hr.	0.348	984.87	0.361	1,021.67	0.389	1,100.91	0.414	1,171.66	0.406	1,149.02
Roofer	176.4	Hr.	0.264	46.57	0.271	47.80	0.268	47.28	0.266	46.92	0.295	52.04
Sheet metal worker	105.3	Hr.	0.342	36.01	0.353	37.17	0.376	39.59	0.403	42.44	0.406	42.75
Ornamental iron worker	17.6	Hr.	0.305	5 37	0.357	6.28	0.397	6.99	0.415	7.30	0.453	7.97
Painter	811.3	Hr.	0 318	257 99	0.328	266.11	0.347	281.52	0.366	296.94	0.378	306.67
Total cost of labor				$ 3,489 42		$ 3,650.45		$ 3,883.79		$ 4,069.68		$ 4,077.25
Grand total				$17,641.35		$16,973.94		$18,297.39		$17,775.32		$17,545.99
Per cent of 1914 cost				93.8		90.3		97.3		94.6		93.3
Reciprocal				1.066		1.107		1.027		1.058		1.071

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH STEEL ROOF TRUSSES.—*(Continued)*

Item	Quantity	Unit	1905		1906		1907		1908		1909	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	314.3	Bbl.	$ 1.16	$ 364.59	1.38	$ 433.73	$ 1.46	$ 458.88	$ 1.27	$ 399.16	$ 1.23	$ 386.59
Lime (300 lb. bbl.)	36.8	Bbl.	0.92	33.86	0.98	36.06	0.99	36.43	1.08	39.74	1.08	39.74
Sand	134.9	Cu. yd.	0.89	120.06	0.95	128.16	0.99	133.55	1.09	147.04	1.09	147.04
Stone, crushed	84.9	Cu. yd.	0.89	75.56	0.95	80.66	0.99	84.05	1.09	92.54	1.09	92.54
Cinders	458.8	Cu. yd.	0.43	197.28	0.44	201.87	0.44	201.87	0.45	206.46	0.46	211.05
Brick, common	201.256	M. brk.	8.73	1,756.96	9.21	1,853.57	6.89	1,386.65	5.84	1,175.34	7.16	1,440.99
Granite, tooled	278.9	Cu. ft.	2.49	694.46	2.55	711.20	2.84	792.08	2.84	792.08	2.87	800.44
Terra cotta coping	61.5	Cu. ft.	0 88	54.12	1.03	63.35	1.04	63.96	1.04	63.96	1.19	73.19
Structural steel	1,567.16	Cwt.	2.72	4,262.68	2.85	4,466.41	2.86	4,482.08	2.80	4,388.05	2 41	3,776.86
Light steel roof trusses	208.10	Cwt.	4.40	915.64	4.62	961.42	4.62	961.42	4.54	944.77	3.89	809.51
Roof sheathing	24.449	M.B.M.	21.15	517.10	26.63	651.08	26.92	658.17	24.31	594.36	23.07	564.04
Roofing, 5 ply, pitch and gravel	100.25	Sqr.	4.48	449.12	4.48	449.12	4.48	449.12	4.48	449.12	4.48	449.12
Framing, simple	13.133	M.B.M.	23.13	303.77	29.13	382.56	29.44	386.44	26.59	349.21	25.23	331.35
Y.P. dressed (flooring for shops)	36.259	M.B.M.	31.65	1,147.60	40.50	1,468.49	40.84	1,480.82	35.88	1,300.97	33.11	1,200.54
2-ply building paper	61.93	Sqr.	0.57	35.30	0.56	34.68	0.57	35.30	0.57	35.30	0.55	34.06
Windows	5,860.0	Sq. ft.	0.31	1,816.60	0.31	1,816.60	0.33	1,933.80	0.31	1,816.60	0.31	1,816.60
Doors, engine house	937.0	Sq. ft.	0.38	356.06	0.41	384.17	0.42	393.54	0.42	393.54	0.41	384.17
Mouldings under 5 in	37.50	C.L.F.	1.29	48.38	1.21	45.38	1.32	49.50	1.27	47.63	1.29	48.38
Nails	20.8	Kegs	1.90	39.52	1.96	40.77	2.12	44.10	2.10	43.68	1.92	39.94
Cast iron	390.0	Lb.	0.033	12.87	0.038	14.82	0.039	15.21	0.031	12.09	0.031	12.09
Wrought iron	14.23	Cwt.	3.74	53.22	3.78	53.79	3.97	56.49	3.63	51.65	3.73	53.08
Miscellaneous iron	126.45	Cwt.	3.74	472.92	3.78	477.98	3.97	502.01	3.63	459.01	3.73	471.66
No. 22 G.I sheets, interior	705.0	Lb.	0.037	26.09	0.039	27.50	0.041	28.91	0.039	27.50	0.037	26.09
16 oz. copper flashing	8.82	Sqr.	20.40	179.93	24.31	214.41	28.41	250.58	18.42	162.46	18.43	162.55
5 in. copper hanging gutter	2.41	C.L.F.	18.90	45.55	22.17	53.43	25.58	61.65	17.34	41.79	17.40	41.93
Leaders 3 by 4 in., 16 oz. copper	1.80	C.L.F.	32.23	58.01	38.12	68.62	44.27	79.69	29.33	52.79	29.39	52.90
Paint, cold water	19.324	Cwt.	1.61	31.11	1.72	33.24	1.72	33.24	1.89	36.52	1.89	36.52
Paint, lead and oil	119.6	Gal.	1.14	136.34	1.18	141.13	1.20	143.52	1.14	136.34	1.22	145.91
Total cost of material				$14,204.70		$15,294.20		$15,203.26		$14,259.70		$13,648.88
Common labor	3,411.8	Hr.	$ 0.193	658.48	$ 0.203	692.60	$ 0.226	771.07	$ 0.228	777.89	$ 0.239	815.42
Brick layers	2,131.9	Hr.	0.594	1,266.35	0.604	1,287.67	0.607	1,294.06	0.612	1,304.72	0.616	1,313.25
Hod carrier	2,193.1	Hr.	0.296	649.16	0.304	666.70	0.316	693.02	0.319	699.60	0.323	708.37
Carpenter	2,830.1	Hr.	0.426	1,205.62	0.441	1,248.07	0.465	1,316.00	0.466	1,318.83	0.476	1,347.13
Roofer	176.4	Hr.	0.290	51.16	0.293	51.69	0.300	52.92	0.364	64.21	0.428	75.50
Sheet metal worker	105.3	Hr.	0.418	44.02	0.425	44.75	0.424	44.65	0.434	45.70	0.445	46.86
Ornamental iron worker	17.6	Hr.	0.468	8.24	0.463	8.15	0.480	8.45	0.498	8.76	0.507	8.92
Painter	811.3	Hr.	0.388	314.78	0.398	322.90	0.414	335.88	0 420	340.75	0.425	344.80
Total cost of labor				$4,197.81		$4,322.53		$4,516.05		$4,560.46		$4,660.25
Grand total				$18,402.51		$19,616.73		$19,719.31		$18,820.16		$18,309.13
Per cent of 1914 cost				97.9		104.4		104.9		100.1		97.4

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH STEEL ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1910		1911		1912		1913		1914	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	314.3	Bbl.	$ 1.26	$ 396.02	$ 1.20	$ 377.16	$ 1.06	$ 333.16	$ 1.32	$ 414.88	$ 1.32	$ 414.88
Lime (300 lb. bbl.)	36.8	Bbl.	1.08	39.74	1.15	42 32	1.13	41 58	1.12	41 22	1.07	39.38
Sand	134.9	Cu. yd.	1.16	156.48	1.16	156 48	1.22	164 58	1.24	167.28	1.25	168 63
Stone, crushed	84.9	Cu. yd.	1.16	98.48	1.16	98 48	1.22	103 58	1.24	105 28	1.25	106.13
Cinders	458.8	Cu. yd.	0.47	215.64	0.47	215 64	0.48	220 22	0.48	220 22	0.48	220.22
Brick, common	201.256	M. brk.	6.51	1,310 18	6.70	1,348 42	7.60	1,529 55	7 64	1,537 60	7.05	1,418 85
Granite, tooled	278.9	Cu. ft.	2.90	808.81	2.93	817.18	2.93	817 18	3.06	853.43	3.19	889.69
Terra cotta coping	61.5	Cu. ft.	1.19	73.19	1.19	73 19	1 19	73 19	1.19	73 19	1.20	73.80
Structural steel	1,567.16	Cwt.	2.48	3,886 56	2.29	3,588 80	2 29	3,588 80	2.53	3,964 91	2.33	3,651.48
Light steel roof trusses	208.10	Cwt.	3.98	828 24	3.70	769.97	3 72	774 13	4 14	861.53	3 77	784 54
Roof sheathing	24.449	M.B.M.	23.48	574 06	23 95	585 55	24 84	607 31	25 63	626 63	23.93	585 06
Roofing, 5 ply, pitch and gravel	100.25	Sqr	4 48	449 12	4.48	449 12	4 48	449 12	4 03	404 01	4 87	488 22
Framing, simple	13.133	M.B.M	25.69	337 39	26.20	344 08	27.16	356.69	28 03	368.12	26 17	343.69
Y.P. dressed (flooring for shops)	36.259	M.B.M.	33.90	1,229.18	34.90	1,265.44	36.00	1,305 32	35.12	1,273.42	30 43	1,103 36
2-ply building paper	61.93	Sqr.	0.52	32 20	0 52	32 20	0.52	32 20	0 52	32 20	0 52	32 20
Windows	5,860.0	Sq. ft.	0 31	1,816.60	0.28	1,640 80	0.27	1,582 20	0 29	1,699.40	0.29	1,699.40
Doors, engine house	937.0	Sq. ft.	0.41	384.17	0.41	384 17	0.42	393 54	0.44	412 28	0.44	412.28
Mouldings under 5 in	37 50	C.L.F.	1.22	45.75	1.17	43.88	1.10	41 25	1.14	42 75	1.13	42.38
Nails	20 8	Kegs	1.89	39.31	1.80	37.44	1.74	36 19	1.82	37 86	1.68	34.94
Cast iron	390 0	Lb.	0.029	11.31	0.026	10.14	0.027	10 53	0.028	10 92	0.025	9.75
Wrought iron	14.23	Cwt.	3.83	54.50	3.64	51 80	3.85	54 79	4.17	59.34	4.00	56 92
Miscellaneous iron	126.45	Cwt.	3.83	484.30	3.64	460.28	3.85	486.83	4.17	527 30	4.00	505.80
No. 22 G.I. sheets, interior	705.0	Lb.	0.037	36 09	0.034	23 97	0.034	23 97	0.036	25 38	0.032	22.56
16 oz. copper flashing	8.82	Sqr.	18.56	163.70	17.16	151.35	21.88	192 98	21.81	192 36	19 43	171 37
5 in. copper hanging gutter	2 41	C.L.F.	17 58	42.37	16 44	39 62	20.42	49.21	20 48	49.36	18.60	44 83
Leaders 3 by 4 in., 16 oz. copper	1 80	C.L.F.	29.64	53.35	27.56	49.61	34.69	62.44	34.68	62.42	31.20	56 16
Paint, cold water	19 324	Cwt.	1.89	36 52	2.00	38 65	1.96	37.88	1 94	37 49	1.85	35.75
Paint, lead and oil	119 6	Gal.	1.45	173.42	1.50	179.40	1 33	159 07	1.20	143.52	1.23	147.11
Total cost of material				$13,766 68		$13,275.14		$13,527 49		$14,244.30		$13,559.38
Common labor	3,411.8	Hr.	$ 0.244	832 48	$ 0 248	846.13	$ 0.259	883.66	$ 0.263	897 30	$ 0.280	955 30
Brick layers	2,131.9	Hr.	0.629	1,340 96	0.629	1,340.96	0.636	1,355.89	0.659	1,404.92	0.674	1,436 90
Hod carrier	2,193.1	Hr.	0.332	728.11	0.336	736 88	0.340	745 65	0.345	756.62	0.350	767.59
Carpenter	2,830 1	Hr.	0.495	1,400.90	0.500	1,415 05	0.509	1,440 52	0.522	1,477.31	0.538	1,522.59
Roofer	176.4	Hr.	0.436	76.91	0.434	76 56	0.432	76 20	0.458	80.79	0.470	82 91
Sheet metal worker	105.3	Hr.	0.462	48.65	0.467	49 18	0.481	50.65	0.506	53.28	0.527	55.49
Ornamental iron worker	17.6	Hr.	0.510	8.98	0.514	9.05	0.542	9.54	0.580	10.21	0.621	10 93
Painter	811.3	Hr.	0.442	358 59	0.458	371.58	0.468	379.69	0.486	394.29	0.502	407.27
Total cost of labor				$ 4,795 58		$ 4,845.39		$ 4,941 80		$ 5,074.72		$ 5,239 00
Grand total				$18,562.26		$18,120.53		$18,469.29		$19,319.02		$18,798.38
Per cent of 1914 cost				98.8		96.4		98.3		102.8		100.0
Reciprocal				1.013		1 037		1.018		0.973		1 000

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH STEEL ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1915		1916		1917		1918		1919	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	314.3	Bbl.	$ 1.19	$ 374.02	$ 1.44	$ 452.59	$ 1.85	581.46	$ 2.27	$ 713.46	$ 2.73	$ 858.04
Lime (300 lb. bbl.)	36.8	Bbl.	1.28	47.10	1.45	53.36	1.82	66.98	2.38	87.58	2.76	101.57
Sand	134.9	Cu. yd.	1.27	171.32	1.35	182.12	1.56	210.44	1.87	252.26	2.01	271.15
Stone, crushed	84.9	Cu. yd.	1.27	107.82	1.35	114.62	1.56	132.44	1.87	158.76	2.01	170.65
Cinders	458.8	Cu. yd.	0.50	229.40	0.51	233.99	0.55	252.34	0.69	316.57	0.75	344.10
Brick, common	201.256	M. brk.	7.05	1,418.85	8.41	1,692.56	9.83	1,978.35	13.95	2,807.52	16.23	3,266.38
Granite, tooled	278.9	Cu. ft.	3.25	906.43	3.29	917.58	3.48	970.57	3.80	1,059.82	4.31	1,202.06
Terra cotta coping	61.5	Cu. ft.	1.20	73.80	1.30	79.95	1.31	80.57	1.33	81.80	1.74	107.01
Structural steel	1,567.16	Cwt.	2.37	3,714.17	4.01	6,284.31	4.70	7,365.65	4.33	6,785.80	3.43	5,375.36
Light steel roof trusses	208.10	Cwt.	3.89	809.51	6.40	1,331.84	6.78	1,410.92	6.57	1,367.22	4.95	1,030.10
Roof sheathing	24.449	M.B.M.	22.83	558.17	26.95	658.90	33.41	816.84	41.06	1,003.88	49.97	1,221.72
Roofing, 5 ply pitch and gravel	100.25	Sqr.	5.02	503.26	6.07	608.52	7.03	704.76	8.05	807.01	10.58	1,060.65
Framing, simple	13.133	M.B.M.	24.97	327.93	29.47	387.03	36.53	479.75	44.91	589.80	54.64	717.59
Y.P. dressed (flooring for shops)	36.259	M.B.M.	30.28	1,097.92	38.55	1,397.78	50.03	1,814.04	64.09	2,323.84	72 27	2,620.44
2-ply building paper	61.93	Sqr.	0.52	32.20	0.70	43.35	0.79	48.92	0.92	56.98	0.96	59.45
Windows	5,860.0	Sq. ft.	0.29	1,697.40	0.32	1,875.20	0.39	2,285.40	0.51	2,988.60	0.63	3,691.80
Doors, engine house	937.0	Sq. ft.	0.44	412.28	0.49	459.13	0.60	562.20	0.67	627.79	0.73	684.01
Mouldings under 5 in	37.50	C.L.F.	1.11	41.63	1 13	42.38	1.27	47.63	1.64	61.50	2.24	84.00
Nails	20.8	Kegs	1.75	36.40	2.60	54.08	3.63	75.50	3.60	74.88	3.52	73.22
Cast iron	390.0	Lb.	0.028	10 92	0.038	14.82	0.066	25.74	0.073	28.47	0.069	26.91
Wrought iron	14.23	Cwt	4.15	59.05	5.73	81.54	7.23	102.88	7.59	108.01	7.15	101.74
Miscellaneous iron	126.45	Cwt.	4.15	524 77	5.73	724.56	7.23	914 23	7.59	959.76	7.15	904.12
No. 22 G.I. sheets, interior	705.0	Lb.	0.041	28.91	0.052	36.66	0.086	60.63	0.069	48.65	0.064	45.12
16 oz. copper flashing	8.82	Sqr.	23.14	204 09	36.55	322.37	39.78	350.86	34 58	305.00	29.40	259.31
5 in. copper hanging gutter	2.41	C.L.F.	21.74	52.39	32 89	79 26	35 68	85.99	31.75	76.52	27.92	67.29
Leaders 3 by 4 in., 16 oz. copper	1.80	C.L.F.	36.81	66.26	56.94	102.49	61.88	111 38	54.40	97.92	47.01	84.62
Paint, cold water	19.324	Cwt.	2.24	43.29	2.54	49 08	3.18	61 45	4 18	80.77	4.83	93.33
Paint, lead and oil	119 6	Gal.	1 29	154.28	1 68	200.93	2.12	253 55	2 61	312.16	2.82	337.27
Total cost of material				$13,705.57		$18,481.00		$21,851.47		$24,182.33		$24,859.01
Common labor	3,411.8	Hr.	$ 0.276	941 66	$ 0.312	1,064.48	$ 0.361	1,231.66	$ 0.466	1,589.90	$ 0.539	1,838.96
Brick layers	2,131.9	Hr.	0.683	1,456.09	0.691	1,473.14	0.736	1,569.08	0.794	1,692.73	0.904	1,927.24
Hod carrier	2,193.1	Hr.	0.352	771.97	0.372	815 83	0.421	923 30	0 501	1,098.74	0.601	1,318.05
Carpenter	2,830.1	Hr.	0.549	1,553 72	0.565	1,599.01	0.621	1,757.49	0.678	1,918.81	0.779	2,204.65
Roofer	176.4	Hr.	0.488	86.08	0.488	86.08	0.492	86.79	0.564	99.49	0.630	111.13
Sheet metal worker	105.3	Hr.	0.536	56 44	0.542	57.07	0.566	59 60	0 649	68.34	0 747	78.66
Ornamental iron worker	17.6	Hr.	0.621	10 93	0.633	11.14	0.682	12 00	0.784	13.80	0.879	15.47
Painter	811.3	Hr.	0.503	408.08	0.532	431.61	0.562	455.95	0.646	524.10	0.740	600.36
Total cost of labor				$ 5,284.97		$ 5,538.36		$ 6,095.87		$7,005.91		$ 8,094.52
Grand total				$18,990.54		$24,019.36		$27,947.34		$31,188.29		$32,953.53
Per cent of 1914 cost				101.0		127.8		148.7		165.9		175.3
				0.990		0.783		0.673		0.603		0.570

ESTIMATED AVERAGE COST OF A TYPICAL BRICK SHOP BUILDING WITH STEEL ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1920		1921		1922		1923	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Cement	314.3	Bbl.	$ 3.44	$ 1,081.19	$ 2.67	$ 839.18	$ 2.36	$ 741.75	$ 2.50	$ 785.75
Lime (300 lb. bbl.)	36.8	Bbl.	3.78	139.10	3.92	144.26	3.94	144 99	4.01	147 57
Sand	134 9	Cu. yd.	3.01	406.05	2.62	353.44	2.22	299 48	2.77	373 67
Stone, crushed	84 9	Cu. yd.	3.01	255 55	2.62	222.44	2.22	188 48	2 77	235 17
Cinders	458.8	Cu. yd.	0.98	449 62	0.98	449.62	0.87	399 16	0.90	412 92
Brick, common	201.256	M. brk.	25.06	5,043 48	20.32	4,089.52	18.34	3,691.04	21 27	4,280 72
Granite, tooled	278.9	Cu. ft.	5.68	1,584 15	6.00	1,673.40	5.30	1,478 17	5.96	1,662 24
Terra cotta coping	61 5	Cu. ft.	1.86	114 39	1.86	114.39	1.73	106.40	1.85	113 78
Structural steel	1,567.16	Cwt.	3.80	5,955 21	2 78	4,356.70	2.82	4,419.39	3.54	5,547 75
Light steel roof trusses	208 10	Cwt.	5 27	1,096 69	3 90	811.59	4.30	894.83	5.34	1,111 25
Roof sheathing	24.449	M.B.M.	59.11	1,445 18	45 78	1,119.28	45.78	1,119 28	49 61	1,212 91
Roofing, 5 ply pitch and gravel	100.25	Sqr.	12 33	1,236 08	11 65	1,167.91	11.65	1,167.91	12.54	1,257 14
Framing, simple	13.133	M.B.M.	64.64	848 92	50 06	657.44	50.06	657.44	54.25	712 47
Y.P. dressed (flooring for shops)	36.259	M.B.M.	82.04	2,974 69	64 24	2,329.28	69.84	2,532.33	79.60	2,886 22
2-ply building paper	61 93	Sqr.	1.54	95 37	1 80	111 47	1.81	112 09	1 80	111 47
Windows	5,860 0	Sq. ft.	0.89	5,215 40	0.63	3.691.80	0.64	3,750 40	0.76	4,453 60
Doors, engine house	937.0	Sq. ft.	1.08	1,011 96	0.86	805.82	0.85	796.45	0.94	880 78
Mouldings under 5 in.	37.50	C.L.F.	3.60	135 00	2.30	86.25	2.70	101.25	3.23	121 13
Nails	20.8	Kegs	4.20	87.36	3.07	63.86	2.53	52.62	2.92	60.74
Cast iron	390.0	Lb.	0.089	34.71	0.066	25.74	0.055	21.45	0.072	28.08
Wrought iron	14.23	Cwt.	9.03	128 50	7.23	102 88	6 48	92.21	7.57	107.72
Miscellaneous iron	126.45	Cwt.	9.03	1,141 84	7.23	914 23	6.48	819 40	7.57	957.23
No. 22 G.I. sheets, interior	705.0	Lb.	0 080	56 40	0.052	36 66	0 047	33.14	0.052	36 66
16 oz. copper flashing	8.82	Sqr.	29.57	260.81	21 64	190 86	21 41	188 84	24.58	216 80
5 in. copper hanging gutter	2.41	C.L.F.	29.13	70 20	22 80	54 95	22 12	53 31	25.42	61.26
Leaders 3 by 4 in., 16 oz. copper	1 80	C.L.F.	48.16	86 69	36 47	65.65	35.72	64 30	41.03	73.86
Paint, cold water	19 324	Cwt.	6.63	128 12	6.88	132.95	6.97	134 69	7.07	136 62
Paint, lead and oil	119.6	Gal.	3.02	361 19	2.20	263.12	2.19	261.92	2.26	270 30
Total cost of material				$31,443 85		$24,874 69		$24,322 72		$28,255 81
Common labor	3,411.8	Hr.	$ 0.697	2,378 02	$ 0.687	2,343 91	$ 0 503	1,716.14	$ 0.631	2,152 85
Brick layers	2,131.9	Hr.	1.166	2,485 80	1.227	2,615.84	1 167	2,487 93	1.325	2,824 77
Hod carrier	2,193.1	Hr.	0.786	1,723 78	0.802	1,758 87	0.672	1,473.76	0.845	1,853 17
Carpenter	2,830.1	Hr.	1.027	2,906 51	1.068	3,022 55	0.958	2,711 24	1.087	3,076 32
Roofer	176.4	Hr.	0.845	149.06	0.932	164.40	0.858	151.35	0.954	168.29
Sheet metal worker	105.3	Hr.	0 975	102 67	1 030	108 46	0 924	97.30	1.067	112 36
Ornamental iron worker	17.6	Hr.	1.100	19 36	1 098	19.32	0 998	17 56	1.099	19 34
Painter	811.3	Hr.	1.000	811.30	1.034	838.88	0.918	744.77	1.033	838.07
Total cost of labor				$10,576.50		$10,872.23		$ 9.400.05		$11,045.17
Grand total				$42,020.35		$35,746.92		$33,722.77		$39,300.98
Per cent of 1914 cost				223.6		190.2		179.38		209.07
Reciprocal				0.447		0.526		0.5574		0.4783

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES

Item	Quantity	Unit	1890		1891		1892		1893	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing, simple	114.180	M.B.M.	$20.62	$ 2,354.39	$19.31	$ 2,204.82	$18.19	$ 2,076.93	$17.82	$ 2,034.69
Framing, truss	70.000	M.B.M.	31.12	2,178.40	28.23	1,976.10	26.54	1,857.80	25.91	1,813.70
Sheathing, interior, S.E. boards	0.310	M.B.M.	21.41	6.64	19.85	6.15	18.70	5.80	18.28	5.67
Sheathing, interior, T. and G.	8.500	M.B.M.	26.95	229.08	25.79	219.22	24.44	207.74	24.19	205.62
Sheathing, roof	57.000	M.B.M.	18.86	1,075.02	17.66	1,006.62	16.63	947.91	16.30	929.10
Flooring, 1 in. T. and G. Y.P.	3.000	M.B.M.	34.58	103.74	33.09	99.27	31.36	94.08	31.03	93.09
Trim, 1 by 4 in. N.C.P.	305.0	L.F.	0.0099	3.02	0.0090	2.75	0.0090	2.75	0.0088	2.68
Windows	358.0	S.F.	0.24	85.92	0.22	78.76	0.22	78.76	0.22	78.76
Doors	151.0	S.F.	0.26	39.28	0.24	36.24	0.24	36.24	0.24	36.24
Doors, ½ glazed	49.0	S.F.	0.25	12.25	0.23	11.27	0.23	11.27	0.23	11.27
Doors, exterior, sliding	12,400.0	S.F.	0.28	3,472.00	0.27	3,348.00	0.27	3,348.00	0.27	3,348.00
Hardware, W.I.	43,570.0	Lb.	0.0299	1,302.74	0.0287	1,250.46	0.0284	1,237.39	0.0267	1,163.32
Hardware, C.I.	4,150.0	Lb.	0.0300	124.50	0.0280	116.20	0.0260	107.90	0.0260	107.90
Hardware, nails	2,592.0	Lb.	0.0297	76.98	0.0247	64.02	0.0219	56.76	0.0199	51.58
Hardware, steel	3,650.0	Lb.	0.0254	92.71	0.0226	82.49	0.0214	78.11	0.0196	71.54
Roofing, slag	550.0	Sqr.	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00
Downspouts, G.I.	380.0	L.F.	0.0862	32.76	0.0820	31.16	0.0802	30.48	0.0782	29.72
Leader heads, G.I.	45.0	S.F.	0.0721	3.24	0.0676	3.04	0.0656	2.95	0.0638	2.87
Ventilators, 24 in. diameter star	14.0	Each	5.59	78.26	5.53	77.42	5.48	76.72	5.40	75.60
Cornice, G.I.	4,660.0	S.F.	0.0663	308.96	0.0652	303.83	0.0636	296.38	0.0620	288.92
Siding, 20 gage 2½ in. corrugated G.I.	156.0	Sqr.	10.29	1,605.24	9.59	1,496.04	9.33	1,455.48	9.05	1,411.80
Paint, L. and O.	121.5	Gal.	1.20	145.80	1.13	137.30	1.09	132.44	1.07	130.01
Paint, hard oil	58.0	Gal.	0.75	43.50	0.67	38.86	0.57	33.06	0.56	32.48
Galvanized iron, 22 gage	134.6	Sqr.	9.10	1,224.86	8.49	1,142.75	8.24	1,109.10	8.00	1,076.80
Skylights, wood frame	936.0	S.F.	0.24	224.64	0.22	205.92	0.22	205.92	0.22	205.92
Total cost of material				$17,287.91		$16,402.69		$15,953.97		$15,671.28
Common (building)	3,519.0	Hr.	$ 0.1612	567 26	$ 0.1630	573.60	$ 0.1627	572.54	$ 0.1616	568.67
Carpenter	7,309.0	Hr.	0.2923	2,136.42	0.2976	2,175.16	0.3019	2,206.59	0.3077	2,248.98
Sheet metal worker	1,691.0	Hr.	0.2855	482.78	0.2972	502.57	0.2983	504.43	0.2984	504.59
Painter	669.0	Hr.	0.2851	190.73	0.2874	192.27	0.2912	194.81	0.2962	198.16
Total cost of labor				$ 3,377.19		$ 3,443.60		$ 3,478.37		$ 3,520.40
Grand total				$20,665.10		$19,846.29		$19,432 34		$19,191 68
Per cent of 1914 cost				79.04		75.91		74.32		73.40
Reciprocal				1.265		1.317		1.346		1.362

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—*(Continued)*

Item	Quantity	Unit	1894		1895		1896		1897	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing, simple	114.180	M.B.M.	$17.46	$ 1,993.58	$16.46	$ 1,879.40	$17.22	$ 1,966.18	$16.93	$ 1,933.07
Framing, truss	70.000	M.B.M.	24.89	1,742.30	22.96	1,607.20	24.89	1,742.30	24.19	1,693.30
Sheathing, interior, S.E. boards	0.310	M.B.M.	17.80	5.52	16.63	5.16	17.56	5.44	17.28	5.36
Sheathing, interior, T. and G.	8.500	M.B.M.	22.58	191.93	19.91	169.24	18.21	154.79	17.12	145.52
Sheathing, roof	57.000	M.B.M.	15.96	909.72	15.05	857.85	15.75	897.75	15.48	882.36
Flooring, 1-in. T. and G. Y.P.	3.000	M.B.M.	28.97	86.91	25.55	76.65	23.37	70.11	21.96	65.88
Trim, 1 by 4 in. N.C.P.	305.0	L.F.	0.0076	2.32	0.0066	2.01	0.0060	1.83	0.0059	1.80
Windows	358.0	S.F.	0.19	68.02	0.17	60.86	0.16	57.28	0.16	57.28
Doors	151.0	S.F.	0.21	31.71	0.19	28.69	0.18	27.18	0.17	25.67
Doors, ½ glazed	49.0	S.F.	0.20	9.80	0.18	8.82	0.17	8.33	0.17	8.33
Doors, exterior, sliding	12,400.0	S.F.	0.26	3,224.00	0.25	3,100.00	0.25	3,100.00	0.24	2,976.00
Hardware, W.I.	43,570.0	Lb.	0.0225	980.33	0.0239	1,041.32	0.0236	1,028.25	0.0233	1,015.18
Hardware, C.I.	4,150.0	Lb.	0.0220	91.30	0.0220	91.30	0.0210	87.15	0.0190	78.85
Hardware, nails	2,592.0	Lb.	0.0165	42.77	0.0212	54.95	0.0293	75.95	0.0149	38.62
Hardware, steel	3,650.0	Lb.	0.0170	62.05	0.0192	70.08	0.0202	73.73	0.0174	63.51
Roofing, slag	550.0	Sqr.	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00
Downspouts, G.I.	380.0	L.F.	0.0706	26.83	0.0727	27.63	0.0700	26.60	0.0672	25.54
Leader heads, G.I.	45.0	S.F.	0.0563	2.53	0.0583	2.62	0.0553	2.49	0.0523	2.35
Ventilators, 24 in. diameter star	14.0	Each	5.11	71.54	5.20	72.80	5.18	72.52	5.11	71.54
Cornice, G.I.	4,660.0	S.F.	0.0555	258.63	0.0573	267.02	0.0549	255.83	0.525	244.65
Siding, 20 gage 2½ in. corrugated G.I.	156.0	Sqr.	7.96	1,241.76	8.22	1,282.32	7.77	1,212.12	7.31	1,140.36
Paint, L. and O.	121.5	Gal.	1.00	121.50	1.01	122.72	0.91	110.57	0.91	110.57
Paint, hard oil	58.0	Gal.	0.56	32.48	0.56	32.48	0.50	29.00	0.51	29.58
Galvanized iron, 22 gage	134.6	Sqr.	7.03	946.24	7.28	979.89	6.88	926.05	6.48	872.21
Skylights, wood frame	936.0	S.F.	0.19	177.84	0.17	159.12	0.16	149.76	0.16	149.76
Total cost of material				$14,785.61		$14,464.13		$14,545.21		$14,101.29
Common (building)	3,519.0	Hr.	$0.1615	568.32	$0.1605	564.80	$0.1612	567.26	$0.1622	570.78
Carpenter	7,309.0	Hr.	0.3034	2,217.55	0.2949	2,155.42	0.2970	2,170.77	0.2965	2,167.12
Sheet metal worker	1,691.0	Hr.	0.2968	501.89	0.2995	506.45	0.3075	519.98	0.3141	531.14
Painter	669.0	Hr.	0.2936	196.42	0.2923	195.55	0.2938	196.55	0.2941	196.75
Total cost of labor				$ 3,484.18		$ 3,422.22		$ 3,454.56		$ 3,465.79
Grand total				$18,269.79		$17,886.35		$17,999.77		$17,567.08
Per cent of 1914 cost				69.88		68.41		68.84		67.19
Reciprocal				1.431		1.462		1.453		1.488

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1898		1899		1900		1901	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing, simple	114.180	M.B.M.	$16.91	$ 1,930.78	$19.71	$ 2,250.49	$22.38	$ 2,555.35	$19.65	$ 2,243.64
Framing, truss	70.000	M.B.M.	24.56	1,719 20	28.41	1,988.70	30.97	2,167.90	26.79	1,875 30
Sheathing, interior, S.E. boards	0.310	M.B.M.	17.33	5.37	20.17	6.25	22.58	7.00	19.72	6 11
Sheathing, interior, T. and G.	8.500	M.B.M.	17.06	145.01	24.19	205.62	21.78	185.13	24 54	208.59
Sheathing, roof	57.000	M.B.M.	15.46	881 22	18.12	1,032 84	20 46	1,166.22	17.97	1,024.29
Flooring, 1 in T. and G. Y.P.	3.000	M.B.M.	21.88	65.64	31 03	93.09	27.94	83.82	31.48	94.44
Trim, 1 by 4 in. N.C.P.	305.0	L F.	0.0067	2 04	0.0093	2.84	0.0114	3.48	0.0136	4.15
Windows	338.0	S.F.	0.18	64 44	0 23	82.34	0.27	96.66	0.33	118 14
Doors	151.0	S.F.	0.19	28.69	0.25	37.75	0.30	45.30	0.35	52.85
Doors, ½ glazed	49.0	S.F.	0.19	9 31	0.24	11 76	0.29	14.21	0.34	16 66
Doors, exterior, sliding	12,400.0	S.F.	0.24	2,976 00	0 28	3,472 00	0 31	3,844.00	0.32	3,968 00
Hardware, W.I.	43,570.0	Lb.	0.0232	1,010.80	0.0313	1,363 74	0.0314	1,368.10	0.0322	1,402 95
Hardware, C.I.	4,150.0	Lb.	0.0190	78.85	0.0250	103 75	0.0290	120.35	0.0280	116.20
Hardware, nails	2,592.0	Lb.	0.0144	37.32	0.239	61 95	0 0263	68.17	0 0237	61 43
Hardware, steel	3,650 0	Lb.	0.0164	59 86	0.0244	89.06	0.0254	92.71	0.0213	77.65
Roofing, slag	550.0	Sqr.	4.48	2,464 00	4 48	2,464.00	4.48	2,464 00	4.48	2,464.00
Downspouts, G.I.	380.0	L.F.	0 0665	25.27	0.0850	32.30	0.0884	33.59	0.0937	35.61
Leader heads, G.I.	45.0	S.F.	0.0516	2.32	0.0695	3.13	0.0718	3 23	0.0765	3.44
Ventilators, 24 in. diameter star	14.0	Each	5.07	70.98	5 84	81.76	6 15	86.10	6.44	90.16
Cornice, G.I.	4,660.0	S.F.	0.0519	241.85	0.0674	314.08	0.0699	325.73	0.0742	345.77
Siding, 20 gage 2½ in. corrugated G.I.	156.0	Sqr.	7.25	1,131 00	9.83	1,533.48	10.13	1,580.28	10.83	1,689.48
Paint, L. and O.	121.5	Gal.	0.95	115.43	1.01	122.72	1.21	147 02	1.15	139.23
Paint, hard oil	58.0	Gal.	0.57	33.06	0.78	45.24	0.85	49.30	0.70	40.60
Galvanized iron, 22 gage	134.6	Sqr.	6.41	862.79	8.69	1,169.67	8.97	1,207.36	9.57	1,288 12
Skylights, wood frame	936.0	S.F.	0.18	168 48	0.23	215.28	0 27	252 72	0.33	308.88
Total cost of material				$14,129 71		$16,783.84		$17,967.73		$17,675.69
Common (building)	3,519.0	Hr.	$ 0.1630	573 60	$ 0.1619	569.73	$ 0.1703	599.29	$ 0.1776	624.97
Carpenter	7,309.0	Hr.	0.3068	2,242 40	0.3149	2,301 60	0.3479	2,542 80	0.3614	2,641.47
Sheet metal worker	1,691 0	Hr.	0.3109	525 73	0.3211	542 98	0.3420	578.32	0 3527	596.42
Painter	669.0	Hr.	0.2973	198.89	0.3051	204.11	0.3176	212 47	0.3283	219 63
Total cost of labor				$ 3,540.62		$ 3,618 42		$ 3,932 88		$ 4,082 49
Grand total				$17,670 33		$20,402 26		$21,900 61		$21,758 18
Per cent of 1914 cost				67 58		78 03		83 76		83.22
Reciprocal				1.480		1.282		1.194		1.202

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—*(Continued)*

Item	Quantity	Unit	1902		1903		1904		1905	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing, simple	114.180	M.B.M.	$20.78	$ 2,373.66	$21.69	$ 2,476 56	$22 01	$ 2,513.10	$23.13	$ 2,640.98
Framing, truss	70.000	M.B.M.	28.35	1,984 50	29.23	2,046.10	29.74	2,081.80	31.34	2,193.80
Sheathing, interior, S.E. boards	0.310	M.B.M.	20.87	6.47	21.71	6.73	22.04	6.83	23.16	7.18
Sheathing, interior, T. and G.	8.500	M.B.M.	25.25	214.63	25.21	214.29	25.21	214.29	26.21	222.79
Sheathing, roof	57 000	M.B.M.	19.00	1,083.00	19.84	1,130.88	20.13	1,147 41	21.15	1,205.55
Flooring, 1 in. T. and G. Y.P.	3.000	M.B.M.	32.39	97.17	32.35	97.05	32.35	97.05	33.63	100.89
Trim, 1 by 4 in. N.C.P.	305.0	L.F.	0.0153	4.67	0.0124	3.78	0.0122	3.72	0.0129	3.93
Windows	358.0	S.F.	0.35	125.30	0.29	103.82	0.29	103.82	0.31	110.98
Doors	151 0	S.F.	0.39	58.89	0.33	49.83	0.32	48.32	0.36	54.36
Doors, ½ glazed	49.0	S F.	0.37	18.13	0.31	15.19	0.31	15.19	0.33	16.17
Doors, exterior, sliding	12,400.0	S.F.	0.35	4,340.00	0.36	4,464.00	0.36	4,464.00	0.38	4,712.00
Hardware, W.I.	43,570.0	Lb.	0.0367	1,599.02	0.0361	1,572.88	0.0348	1,516.24	0.0374	1,629.52
Hardware, C.I.	4,150.0	Lb.	0.0330	136.95	0.0350	145.25	0.0290	120.35	0.0330	136 95
Hardware, nails	2,592.0	Lb.	0.0210	54.43	0.0208	53.91	0.0191	49 51	0.0190	49 25
Hardware, steel	3,650.0	Lb.	0.0247	90.06	0.0221	80.57	0.0206	75.09	0.0218	79 47
Roofing, slag	550.0	Sqr.	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00
Downspouts, G.I.	380.0	L.F.	0.0876	33.29	0.0814	30.93	0.0739	28.08	0.0771	29.30
Leader heads, G.I.	45.0	S.F.	0.0695	3.13	0.0622	2.80	0.0550	2.48	0.0573	2.58
Ventilators, 24 in. diameter star	14.0	Each	6.40	89.60	6.39	89.46	6.14	85.96	6.35	88.90
Cornice, G.I.	4,660.0	S.F.	0.0688	320.61	0.0632	294.51	0.0570	265.62	0.0593	276.34
Siding, 20 gage 2½ in. corrugated G.I.	156.0	Sqr.	9.77	1,524.12	8.64	1,347.84	7.55	1,177.80	7.90	1,232.40
Paint, L. and O.	121.5	Gal.	1.09	132.44	1.09	132.44	1.06	128.79	1.14	138.51
Paint, hard oil	58.0	Gal.	0.84	48.72	0.95	55.10	0.96	55.68	1.05	60.90
Galvanized iron, 22 gage	134.6	Sqr.	8.62	1,160.25	7.63	1,027.00	6.68	899.13	6.97	938.16
Skylights, wood frame	936.0	S.F.	0.35	327.60	0.29	271.44	0.29	271.44	0.31	290.16
Total cost of material				$18,290.64		$18,176.36		$17,835.70		$18,685.07
Common (building)	3.519.0	Hr.	$ 0.1867	657.00	$ 0.1928	678 46	$ 0.1947	685.15	$ 0.1931	679.52
Carpenter	7,309.0	Hr.	0.3890	2,843.20	0.4135	3,022.27	0.4061	2,968.18	0.4265	3,117.29
Sheet metal worker	1,691.0	Hr.	0.3760	635 82	0.4026	680.80	0.4059	686.38	0.4179	706.67
Painter	669.0	Hr.	0.3466	231.88	0.3665	245.19	0.3775	252.55	0.3879	259.51
Total cost of labor				$ 4,367.90		$ 4,626.72		$ 4,592.26		$ 4,762.99
Grand total				$22,658 54		$22,803.08		$22,427.96		$23,448.06
Per cent of 1914 cost				86 66		87.21		85.78		89 68
Reciprocal				1.154		1.147		1.166		1 115

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1906		1907		1908		1909	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing simple	114.180	M.B.M.	$29.13	$ 3,326.06	$29.44	$ 3,361.46	$26.59	$ 3,036.05	$25.23	$ 2,880.76
Framing, truss	70.000	M.B.M.	40.10	2,807.00	40.43	2,830.10	35.52	2,486.40	32.78	2,294.60
Sheathing, interior, S.E. boards	0.310	M.B.M.	29.33	9.09	29.63	9.19	26.49	8.21	24.92	7.73
Sheathing interior, T. and G.	8.500	M.B.M.	31.54	268.09	32.18	273.53	32.25	274.12	31.99	271.92
Sheathing, roof	57.000	M.B.M.	26.63	1,517.91	26.92	1,534.44	24.31	1,385.67	23.07	1,314.99
Flooring, 1 in. T. and G. Y.P.	3.000	M.B.M.	40.47	121.41	41.29	123.87	41.37	124.11	41.05	123.15
Trim, 1 by 4 in. N.C.P.	305.0	L.F.	0.0121	3.69	0.0132	4.03	0.0127	3.87	0.0129	3.93
Windows	358.0	S.F.	0.31	110.98	0.33	118.14	0.31	110.98	0.31	110.98
Doors	151.0	S.F.	0.35	52.85	0.37	55.87	0.36	54.36	0.36	54.36
Doors, ½ glazed	49.0	S.F.	0.33	16.17	0.35	17.15	0.33	16.17	0.34	16.66
Doors, exterior, sliding	12,400.0	S.F.	0.41	5,084.00	0.42	5,208.00	0.42	5,208.00	0.41	5,084.00
Hardware, W.I.	43,570.0	Lb.	0.0378	1,646.95	0.0397	1,729.73	0.0363	1,581.59	0.0373	1,625.16
Hardware, C.I.	4,150.0	Lb.	0.0380	157.70	0.0390	161.85	0.0310	128.65	0.0310	128.65
Hardware, nails	2,592.0	Lb.	0.0196	50.80	0.0212	54.95	0.0210	54.43	0.0192	49.77
Hardware, steel	3,650.0	Lb.	0.0227	82.76	0.0228	83.12	0.0222	81.03	0.0192	70.08
Roofing, slag	550.0	Sqr.	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00
Downspouts, G.I.	380.0	L.F.	0.0798	30.32	0.0832	31.62	0.0808	30.70	0.0781	29.68
Leader heads, G.I.	45.0	S.F.	0.0598	2.69	0.0632	2.84	0.0603	2.71	0.0572	2.57
Ventilators, 24 in. diameter star	14.0	Each	6.51	91.14	6.62	92.68	6.62	92.68	6.62	92.68
Cornice, G.I.	4,660.0	S.F.	0.0616	287.06	0.0645	300.57	0.0623	290.32	0.0599	279.13
Siding, 20 gage 2½ in. corrugated G.I.	156.0	Sqr.	8.22	1,282.32	8.72	1,360.32	8.29	1,293.24	7.81	1,218.36
Paint, L. and O.	121.5	Gal.	1.18	143.37	1.20	145.80	1.14	138.51	1.22	148.23
Paint, hard oil	58.0	Gal.	1.10	63.80	1.05	60.90	0.78	45.24	0.87	50.46
Galvanized iron, 22 gage	134.6	Sqr.	7.28	979.89	7.72	1,039.11	7.34	987.96	6.92	931.43
Skylights, wood frames	936.0	S.F.	0.31	290.16	0.33	308.88	0.31	290.16	0.31	290.16
Total cost of material				$20,890.21		$21,372.15		$20,189.16		$19,543.44
Common (building)	3,519.0	Hr.	$ 0.2028	713.65	$ 0.2255	793.53	$ 0.2276	800.92	$ 0.2391	841.39
Carpenter	7,309.0	Hr.	0.4412	3,224.73	0.4647	3,396.49	0.4656	3,403.07	0.4765	3,482.74
Sheet meta' worker	1,691.0	Hr.	0.4250	718.68	0.4241	717.13	0.4343	734.40	0.4450	752.50
Painter	669.0	Hr.	0.3979	266.20	0.4145	277.30	0.4195	280.65	0.4248	284.19
Total cost of labor				$ 4,923.26		$ 5,184.47		$ 5,219.04		$5,360.82
Grand total				$25,813.47		$26,556 62		$25,408.20		$24,904.26
Per cent of 1914 cost				98.73		101.57		97 18		95.25
Reciprocal				1.013		0.985		1.029		1.050

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1910		1911		1912		1913	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing, simple	114.180	M.B.M.	$25.67	$ 2,931.00	$26.20	$ 2,991.52	$27.16	$ 3,101.13	$28.03	$ 3,200.47
Framing, truss	70.000	M.B.M.	33.56	2,349.20	34.56	2,419.20	35.64	2,494.80	34.77	2,433.90
Sheathing, interior, S.E. boards	0.310	M.B.M.	25.42	7.88	26.02	8.07	26.92	8.35	27.29	8.46
Sheathing, interior, T. and G.	8.500	M.B.M.	31.80	270.30	31.12	264.52	31.73	269.71	33.92	288.32
Sheathing, roof	57.000	M.B.M.	23.48	1,338.36	23.95	1,365.15	24.84	1,415.88	25.63	1,460.91
Flooring, 1 in. T. and G. Y.P.	3.000	M.B.M.	40.80	122.40	39.93	119.79	40.72	122.16	43.52	130.56
Trim, 1 by 4 in. N.C.P.	305.0	L.F.	0.0122	3.72	0.0117	3.57	0.0110	3.36	0.0114	3.48
Windows	358.0	S.F.	0.31	110.98	0.28	100.24	0.27	96.66	0.29	103.82
Doors	151.0	S.F.	0.36	54.36	0.31	46.81	0.30	45.30	0.31	46.81
Doors, ½ glazed	49.0	S.F.	0.33	16.17	0.30	14.70	0.29	14.21	0.30	14.70
Doors, exterior, sliding	12,400.0	S.F.	0.41	5,084.00	0.41	5,084.00	0.42	5,208.00	0.44	5,456.00
Hardware, W.I.	43,570.0	Lb.	0.0383	1,668.73	0.0364	1,585.95	0.0385	1,677.45	0.0417	1,816.87
Hardware, C.I.	4,150.0	Lb.	0.0290	120.35	0.0260	107.90	0.0270	112.05	0.0280	116.20
Hardware, nails	2,592.0	Lb.	0.0189	48.99	0.0180	46.66	0.0174	45.10	0.0182	47.17
Hardware, steel	3,650.0	Lb.	0.0198	72.27	0.0182	66.43	0.0182	66.43	0.0199	72.64
Roofing, slag	550.0	Sqr.	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00	4.03	2,216.50
Downspouts, G.I.	380.0	L.F.	0.0797	30.29	0.0747	28.39	0.0758	28.80	0.0807	30.67
Leader heads, G.I.	45.0	S.F.	0.0579	2.61	0.0528	2.38	0.0533	2.40	0.0571	2.57
Ventilators, 24 in. diameter star	14.0	Each	6.81	95.34	6.68	93.52	6.83	95.62	7.23	101.22
Cornice, G.I.	4,660.0	S.F.	0.0609	283.79	0.0567	264.22	0.0574	267.48	0.0613	285.66
Siding, 20 gage 2½ in. corrugated G.I.	156.0	Sqr.	7.90	1,232.40	7.14	1,113.84	7.18	1,120.08	7.70	1,201.20
Paint, L. and O.	121.5	Gal.	1.45	176.18	1.50	182.25	1.33	161.60	1.20	145.80
Paint, hard oil	58.0	Gal.	1.22	70.76	1.23	71.34	0.87	50.46	0.76	44.08
Galvanized iron, 22 gage	134.6	Sqr.	6.97	938.16	6.31	849.33	6.35	854.71	6.81	916.63
Skylights, wood frame	936.0	S.F.	0.31	290.16	0.28	262.08	0.27	252.72	0.29	271.44
Total cost of material				$19,782.40		$19,555.86		$19,978.46		$20,416.08
Common (building)	3,519.0	Hr.	$ 0.2439	858.28	$ 0.2476	871.30	$ 0.2591	911.77	$ 0.2633	926.55
Carpenter	7,309.0	Hr.	0.4951	3,618.69	0.5000	3,654.50	0.5094	3,723.20	0.5223	3,817.49
Sheet metal worker	1,691.0	Hr.	0.4625	782.09	0.4670	789.70	0.4810	813.37	0.5060	855.65
Painter	669.0	Hr.	0.4419	295.63	0.4575	306.07	0.4685	313.43	0.4862	325.27
Total cost of labor				$ 5,554.69		$ 5,621.57		$ 5,761.77		$ 5,924.96
Grand total				$25,337.09		$25,177.43		$25,740.23		$26,341.04
Per cent of 1914 cost				96.91		96.30		98.45		100.75
Reciprocal				1.032		1.038		1.016		0.993

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1906		1907		1908		1909	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing simple	114.180	M.B.M.	$29.13	$ 3,326.06	$29.44	$ 3,361.46	$26.59	$ 3,036.05	$25.23	$ 2,880.76
Framing, truss	70.000	M.B.M.	40.10	2,807.00	40.43	2,830.10	35.52	2,486.40	32.78	2,294.60
Sheathing, interior, S.E. boards	0.310	M.B.M.	29.33	9.09	29.63	9.19	26.49	8.21	24.92	7.73
Sheathing interior, T. and G.	8.500	M.B.M.	31.54	268.09	32.18	273.53	32.25	274.12	31.99	271.92
Sheathing, roof	57.000	M.B.M.	26.63	1,517.91	26.92	1,534.44	24.31	1,385.67	23.07	1,314.99
Flooring, 1 in. T. and G. Y.P.	3.000	M.B.M.	40.47	121.41	41.29	123.87	41.37	124.11	41.05	123.15
Trim, 1 by 4 in. N.C.P.	305.0	L.F.	0.0121	3.69	0.0132	4.03	0.0127	3.87	0.0129	3.93
Windows	358.0	S.F.	0.31	110.98	0.33	118.14	0.31	110.98	0.31	110.98
Doors	151.0	S.F.	0.35	52.85	0.37	55.87	0.36	54.36	0.36	54.36
Doors, ½ glazed	49.0	S.F.	0.33	16.17	0.35	17.15	0.33	16.17	0.34	16 66
Doors, exterior, sliding	12,400.0	S.F.	0.41	5,084.00	0.42	5,208.00	0.42	5,208.00	0.41	5,084 00
Hardware, W.I.	43,570.0	Lb.	0.0378	1,646.95	0.0397	1,729.73	0.0363	1,581.59	0.0373	1,625 16
Hardware, C.I.	4,150.0	Lb.	0.0380	157.70	0.0390	161.85	0.0310	128.65	0.0310	128 65
Hardware, nails	2,592.0	Lb.	0.0196	50.80	0.0212	54.95	0.0210	54.43	0.0192	49.77
Hardware, steel	3,650.0	Lb.	0.0227	82.76	0.0228	83.12	0.0222	81.03	0.0192	70.08
Roofing, slag	550.0	Sqr.	4 48	2,464.00	4.48	2,464.00	4.48	2,464.00	4.48	2,464.00
Downspouts, G.I.	380.0	L.F.	0.0798	30.32	0.0832	31.62	0.0808	30.70	0.0781	29.68
Leader heads, G.I.	45.0	S.F.	0.0598	2.69	0.0632	2.84	0.0603	2.71	0.0572	2.57
Ventilators, 24 in. diameter star	14.0	Each	6.51	91.14	6.62	92.68	6.62	92.68	6.62	92.68
Cornice, G.I.	4,660.0	S.F.	0.0616	287.06	0.0645	300.57	0.0623	290.32	0.0599	279.13
Siding, 20 gage 2½ in. corrugated G.I.	156.0	Sqr.	8.22	1,282.32	8.72	1,360.32	8.29	1,293.24	7.81	1,218.36
Paint, L. and O.	121.5	Gal.	1.18	143.37	1.20	145.80	1.14	138.51	1.22	148.23
Paint, hard oil	58.0	Gal.	1.10	63.80	1.05	60.90	0.78	45.24	0.87	50.46
Galvanized iron, 22 gage	134.6	Sqr.	7.28	979.89	7.72	1,039.11	7.34	987.96	6.92	931.43
Skylights, wood frames	936.0	S.F.	0.31	290.16	0.33	308.88	0.31	290.16	0.31	290.16
Total cost of material				$20,890.21		$21,372.15		$20,189.16		$19,543.44
Common (building)	3,519.0	Hr.	$ 0.2028	713.65	$ 0.2255	793.53	$ 0.2276	800.92	$ 0.2391	841.39
Carpenter	7,309.0	Hr.	0.4412	3,224.73	0.4647	3,396.49	0.4656	3,403.07	0.4765	3,482.74
Sheet meta' worker	1,691.0	Hr.	0.4250	718.68	0.4241	717.13	0.4343	734.40	0.4450	752.50
Painter	669.0	Hr.	0.3979	266.20	0.4145	277.30	0.4195	280.65	0.4248	284.19
Total cost of labor				$ 4,923.26		$ 5,184.47		$ 5,219.04		$5,360.82
Grand total				$25,813.47		$26,556.62		$25,408.20		$24,904.26
Per cent of 1914 cost				98.73		101 57		97 18		95.25
Reciprocal				1.013		0.985		1.029		1.050

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1910		1911		1912		1913	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing, simple	114.180	M.B.M.	$25.67	$ 2,931.00	$26.20	$ 2,991.52	$27.16	$ 3,101.13	$28.03	$ 3,200.47
Framing, truss	70.000	M.B.M.	33.56	2,349.20	34.56	2,419.20	35.64	2,494.80	34.77	2,433.90
Sheathing, interior, S.E. boards	0.310	M.B.M.	25.42	7.88	26.02	8.07	26 92	8.35	27.29	8.46
Sheath ng, inter or, T. and G	8.500	M.B.M.	31 80	270.30	31.12	264.52	31.73	269.71	33.92	288.32
Sheathing, roof	57.000	M.B.M.	23 48	1,338.36	23.95	1,365.15	24.84	1,415.88	25 63	1,460.91
Flooring, 1 in. T and G. Y.P.	3 000	M.B.M.	40 80	122.40	39.93	119.79	40.72	122.16	43.52	130.56
Trim, 1 by 4 in. N.C.P.	305 0	L.F.	0.0122	3.72	0.0117	3.57	0.0110	3.36	0.0114	3.48
Windows	358.0	S.F.	0.31	110.98	0.28	100.24	0.27	96.66	0.29	103.82
Doors	151.0	S.F.	0.36	54.36	0.31	46.81	0.30	45.30	0.31	46.81
Doors, ½ glazed	49 0	S.F.	0.33	16 17	0.30	14.70	0 29	14.21	0.30	14.70
Doors, exterior, sliding	12,490 0	S.F	0 41	5,084 00	0.41	5,084.00	0.42	5,208.00	0.44	5,456.00
Hardware, W.I.	43,570.0	Lb.	0 0383	1,668 73	0.0364	1,585.95	0.0385	1,677.45	0.0417	1,816 87
Hardware, C.I.	4,150.0	Lb.	0.0290	120 35	0.0260	107 90	0 0270	112.05	0.0280	116.20
Hardware, nails	2,592.0	Lb.	0.0189	48.99	0.0180	46 66	0.0174	45.10	0.0182	47.17
Hardware, steel	3,650.0	Lb.	0.0198	72 27	0.0182	66 43	0.0182	66.43	0.0199	72.64
Roofing, slag	550 0	Sqr.	4.48	2,464 00	4.48	2,464 00	4.48	2,464.00	4.03	2,216.50
Downspouts, G.I.	380 0	L.F.	0.0797	30 29	0.0747	28.39	0.0758	28.80	0.0807	30.67
Leader heads, G.I.	45.0	S.F.	0.0579	2.61	0.0528	2 38	0.0533	2 40	0.0571	2.57
Ventilators, 24 in. diameter star	14.0	Each	6 81	95.34	6 68	93 52	6 83	95.62	7 23	101.22
Cornice, G.I.	4,660.0	S.F.	0.0609	283 79	0.0567	264.22	0.0574	267.48	0.0613	285.66
Siding, 20 gage 2½ in. corrugated G.I.	156 0	Sqr.	7 90	1,232.40	7.14	1,113.84	7.18	1,120.08	7.70	1,201.20
Paint, L. and O.	121 5	Gal.	1.45	176.18	1.50	182.25	1.33	161.60	1.20	145.80
Paint, hard oil	58 0	Gal.	1.22	70.76	1.23	71 34	0.87	50.46	0.76	44.08
Galvanized iron, 22 gage	134 6	Sqr.	6.97	938.16	6.31	849.33	6.35	854.71	6.81	916.63
Skylights, wood frame	936 0	S.F.	0.31	290.16	0.28	262.08	0.27	252.72	0.29	271.44
Total cost of material				$19,782.40		$19,555.86		$19,978.46		$20,416.08
Common (building)	3,519.0	Hr.	$ 0.2439	858.28	$ 0.2476	871.30	$ 0.2591	911.77	$ 0.2633	926.55
Carpenter	7,309.0	Hr.	0.4951	3,618 69	0.5000	3,654.50	0.5094	3,723.20	0.5223	3,817.49
Sheet metal worker	1,691.0	Hr.	0 4625	782 09	0.4670	789.70	0.4810	813.37	0.5060	855.65
Painter	669.0	Hr.	0.4419	295 63	0.4575	306.07	0.4685	313.43	0.4862	325.27
Total cost of labor				$ 5,554 69		$ 5,621.57		$ 5,761.77		$ 5,924.96
Grand total				$25,337 09		$25,177.43		$25,740.23		$26,341 04
Per cent of 1914 cost				96 91		96 30		98.45		100 75
Reciprocal				1.032		1.038		1.016		0.993

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1914		1915		1916		1917	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing, simple	114.180	M.B.M.	$26.17	$ 2,988.09	$24.97	$ 2,851.07	$29.47	$ 3,364.88	$36.53	$ 4,171.00
Framing, truss	70.000	M.B.M.	30.13	2,109.10	29.98	2,098.60	38.17	2,671 90	49.53	3,467.10
Sheathing, interior, S.E. boards	0.310	M.B.M.	24 90	7.72	24 05	7.46	29.08	9.01	36.63	11 36
Sheathing, interior, T. and G.	8.500	M.B.M.	32.12	273.02	30.03	255.26	32.57	276.85	38.67	328.70
Sheathing, roof	57.000	M.B.M.	23.93	1,364.01	22.83	1,301.31	26.95	1,536.15	33.41	1,904 37
Flooring, 1 in. T. and G. Y.P.	3 000	M.B.M.	41.21	123 63	38.53	115.59	41.79	125.37	49.62	148.86
Trim, 1 by 4½ n. N.C.P.	305 0	L.F.	0.0113	3.45	0.0111	3.39	0.0113	3 45	0.0127	3.87
Windows	358 0	S.F.	0 29	103.82	0 29	103 82	0.32	114.56	0.39	139.62
Doors	151.0	S.F.	0.31	46.81	0.32	48.32	0 36	54.36	0.44	66.44
Doors, ½ glazed	49.0	S.F.	0.30	14 70	0.31	15.19	0 33	16.17	0.42	20 58
Doors, exterior, sliding	12,400.0	S.F.	0 44	5,456.00	0.44	5,456 00	0.44	6,076.00	0.60	7,440.00
Hardware, W.I.	43,570 0	Lb.	0.0400	1,742 80	0.0415	1,808 16	0.0573	2,496.56	0.0723	3,150.11
Hardware, C I.	4,150.0	Lb.	0.0250	103 75	0.0280	116 20	0.0380	157.70	0.0660	273.90
Hardware, nails	2,592.0	Lb.	0 0168	43 55	0.0175	45 36	0.0260	67 39	0.0363	94.09
Hardware, steel	3,650.0	Lb	0.0185	67 53	0.0186	67.89	0.0322	117.53	0.0402	146.73
Roofing, slag	550 0	Sqr.	4.87	2,678 50	5.02	2,761.00	6.07	3,338.50	7.03	3,866 50
Downspouts, G.I.	380.0	L.F.	0.0753	28 61	0.0888	33 74	0.1063	41.39	0 1561	59.32
Leader heads, G.I.	45.0	S.F.	0.0509	2.29	0.0636	2 86	0.0805	3.62	0.1285	5.78
Ventilators, 24 in. diameter star	14.0	Each	7.20	100.80	7 77	108.78	8.47	118.58	10.54	147.56
Cornice, G.I.	4,660 0	S.F.	0.0564	262.84	0.0677	315.48	0.0823	383.52	0.1240	577.84
Siding, 20 gage 2½ in. corrugated G.I.	156 0	Sqr.	7.33	1,143 48	8.61	1,343 16	11 07	1,726.92	18.05	2,815 80
Paint, L. and O.	121.5	Gal.	1.23	149.45	1.29	156.74	1 68	204 12	2.12	257 58
Paint, hard oil	58.0	Gal.	0.83	48 14	0.82	47.56	0 92	53.36	1 00	58.00
Galvanized iron, 22 gage	134 6	Sqr.	6 48	872.21	7.61	1,024.31	9.79	1,317 73	15 98	2,150.91
Skylights, wood frame	936 0	S.F.	0 29	271.44	0.29	271.44	0.32	299.52	0 39	365.04
Total cost of material				$20,005 74		$20,358.69		$24,575.14		$31,671.06
Common (building)	3,519.0	Hr.	$ 0 2798	984 62	$ 0 2760	971 24	$ 0.3124	1,099 34	$ 0.3607	1,269.30
Carpenter	7,309.0	Hr.	0.5376	3,929.32	0.5491	4,013.37	0.5653	4,131.78	0.6213	4,541.08
Sheet metal worker	1,691.0	Hr.	0.5267	890 65	0.5362	906 71	0.5424	917 20	0.5661	957.28
Painter	669.0	Hr.	0.5019	335.77	0.5028	336.37	0.5325	356.24	0.5617	375.78
Total cost of labor				$ 6,140 36		$ 6,227.69		$ 6,504 56		$ 7,143.44
Grand total				$26,146.10		$26,586.38		$31,079.70		$38,814.50
Per cent of 1914 cost				100.00		101.68		118.87		148.45
Reciprocal				1.000		0.983		0.841		0.674

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1918		1919		1920	
			Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing, simple	114.180	M.B.M.	$44.91	$ 5,127.82	$54.64	$ 6,238.80	$64.64	$ 7,380.60
Framing, truss	70.000	M.B.M.	63.45	4,441.50	71.56	5,009.20	81.23	5,686.10
Sheathing, interior, S.E. boards	0.310	M.B.M.	45.64	14 15	54.13	16.78	63.20	19.59
Sheathing, interior, T. and G	8.500	M.B.M.	37.47	318.50	55.25	469.63	405.26	894.71
Sheathing, roof	57.000	M.B.M.	41.06	2,340.42	49.97	2,848.29	59.11	3,369.27
Flooring, 1 in. T. and G. Y.P.	3.000	M.B.M.	48.09	144.27	70.88	212.64	135.05	405.15
Trim, 1 by 4 in. N.C.P.	305.0	L.F.	0.0164	5.00	0.0224	6.83	0.0360	10 98
Windows	358.0	S.F.	0.51	182.58	0.63	225.54	0.89	318.62
Doors	151.0	S.F.	0.55	83.05	0.69	104.19	1.03	155.53
Doors, ½ glazed	49.0	S.F.	0.53	25.97	0.66	32.34	0.96	47 04
Doors, exterior, sliding	12,400.0	S.F.	0.67	8,308 00	0.73	9,052 00	1.08	13,392 00
Hardware, W.I.	43,570.0	Lb.	0.0759	3,306.96	0.0715	3,115.26	0.0903	3,934 37
Hardware, C.I.	4,150.0	Lb.	0.0730	302.95	0.0690	286.35	0.0890	369 35
Hardware, nails	2,592.0	Lb.	0.0360	93.31	0.0352	91.24	0.0420	108 86
Hardware, steel	3,650.0	Lb.	0.0358	130.67	0 0293	106.95	0.0331	120 82
Roofing, slag	550.0	Sqr.	8.05	4,427.50	10.58	5,819.00	12.33	6,781.50
Downspouts, G.I.	380.0	L.F.	0.1354	51.45	0.1338	50.84	0.1700	64.60
Leader heads, G.I.	45.0	S.F.	0.1047	4.71	0.0987	4.44	0.1241	5.58
Ventilators, 24 in. diameter star	14.0	Each	10.46	146.44	11.21	156 94	14.45	202.30
Cornice, G.I.	4,660.0	S.F.	0.1056	492.10	0.1027	478.58	0.1301	606.27
Siding, 20 gage 2½ in. corrugated G.I.	156.0	Sqr.	14.43	2,251.08	13.37	2,085 72	16.69	2,603.64
Paint, L. and O.	121.5	Gal.	2.61	317.12	2.82	342.63	3.02	366.93
Paint, hard oil	58.0	Gal.	1.28	74.24	2.25	130.50	3.05	176.90
Galvanized iron, 22 gage	134.6	Sqr.	12.76	1,717.50	11.82	1,590.97	14.77	1,988.04
Skylights, wood frame	936.0	S.F.	0.51	477.36	0 63	589.68	0.89	833.04
Total cost of material				$34,784.65		$39,065.34		$49,841.79
Common (building)	3,519.0	Hr.	$ 0.4659	1,636.50	$ 0.5391	1,897.09	$ 0.6967	2,100.49
Carpenter	7,309.0	Hr.	0.6784	4,958.43	0.7786	5,690.79	1.0268	7,504.88
Sheet metal worker	1,691.0	Hr.	0.6492	1,097.80	0.7471	1,263.35	0.9750	1,648.73
Painter	669.0	Hr.	0.6465	432.51	0.7402	495.19	1.0000	669.00
Total cost of labor				$ 8,125.24		$ 9,346.42		$11,923 10
Grand total				$42,909.89		$48,411.76		$61,764.89
Per cent of 1914 cost				164.12		185.16		236.23
Reciprocal				0.609		0.540		0.423

ESTIMATED AVERAGE COST OF A TYPICAL CORRUGATED IRON PIER SHED WITH WOOD ROOF TRUSSES.—(*Continued*)

Item	Quantity	Unit	1921		1922		1923	
			Unit price	Amount	Unit price	Amount	Unit price	Amount
Framing, simple	114.180	M.B.M.	$50.06	$ 5,715.85	$50.06	$ 5,715.85	$54.25	$ 6,194.27
Framing, truss	70.000	M.B.M.	63.60	4,452.00	69.15	4,840.50	78.82	5,517.40
Sheathing, interior, S.E. boards	0.310	M.B.M.	49.10	15.22	50.50	15.66	55.68	17.26
Sheathing, interior, T. and G	8.500	M.B.M.	66.10	561.85	66.84	568.14	77.73	660.71
Sheathing, roof	57.000	M.B.M.	45.78	2,609.46	45.78	2,609.46	49.61	2,827.77
Flooring, 1-in. T. and G. Y.P.	3.000	M.B.M.	84.81	254.43	85.76	257.25	99.73	299.19
Trim, 1 by 4 in. N.C.P.	305.0	L.F.	0.0230	7.02	0.0270	8.24	0.0323	9.85
Windows	358.0	S.F.	0.63	225.54	0.640	229.12	0.760	272.08
Doors	151.0	S.F.	0.68	102.68	0.750	113.25	0.900	135.90
Doors, ½ glazed	49.0	S.F.	0.65	31.85	0.690	33.81	0.820	40.18
Doors, exterior, sliding	12,400.0	S.F.	0.86	10,664.00	0.850	10,540.00	0.940	11,656.00
Hardware, W.I.	43,570.0	Lb.	0.0723	3,150.11	0.0648	2,823.34	0.0757	3,298.25
Hardware, C.I.	4,150.0	Lb.	0.0660	273.90	0.0550	228.25	0.0720	298.80
Hardware, nails	2,592.0	Lb.	0.0307	79.57	0.0253	65.58	0.0291	75.43
Hardware, steel	3,650.0	Lb.	0.0239	87.24	0.0233	85.05	0.0294	107.31
Roofing, slag	550.0	Sqr.	11.65	6,407.50	11.65	6,407.50	12.54	6,897.00
Downspouts, G.I.	380.0	L.F.	0.1327	50.43	0.1193	45.33	0.1345	51.11
Leader heads, G.I.	45.0	S.F.	0.0864	3.89	0.775	3.49	0.0865	3.89
Ventilators, 24 in. diameter star	14.0	Each	13.61	190.54	12.23	171.22	14.00	196.00
Cornice, G.I.	4,660.0	S.F.	0.0991	461.81	0.0889	414.27	0.1001	466.47
Siding, 20 gage 2½ in. corrugated G.I.	156.0	Sqr.	11.26	1,756.56	10.16	1,584.96	11.24	1,753.44
Paint, L. and O.	121.5	Gal.	2.20	267.30	2.19	266.09	2.26	274.59
Paint, hard oil	58.0	Gal.	1.20	69.60	1.91	110.78	2.50	145.00
Galvanized iron, 22 gage	134.6	Sqr.	9.79	1,317.73	8.80	1,184.48	9.75	1,312.35
Skylights, wood frame	936.0	S.F.	0.63	589.68	0.64	599.04	0.76	711.36
Tota cost of material				$39,345.76		$38,920.66		$43,221.61
Common (building)	3,519.0	Hr.	$ 0.6871	2,417.90	$ 0.5027	1,769.00	$ 0.6312	2,221.19
Carpenter	7,309.0	Hr	1.0679	7,805.28	0.9582	7,003.48	1.0866	7,941.96
Sheet metal worker	1,691.0	Hr.	1.0304	1,742.41	0.9240	1,562.48	1.0669	1,804.13
Painter	669.0	Hr.	1.0339	691.68	0.9175	613.81	1.0330	691.08
Total cost of labor				$12,657.27		$10,948.77		$12,658.36
Grand total				$52,003.03		$49,869.43		$55,879.97
Per cent of 1914 cost				198.89		190.73		213.72
Reciprocal				0.503		0.524		0.468

ESTIMATED AVERAGE COST OF A TYPICAL PIER SHED—STEEL FRAME—CORRUGATED IRON SIDING

Item	Quantity	Unit	1890		1891		1892		1893		1894	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Structural steel	1,012,641	Lb.	$ 0 0309	$31,291	$ 0.0280	$28,354	$ 0.0264	$26,734	$ 0.0245	$24,810	$ 0.0213	$21,569
No. 20 gage corrugated galvanized iron	333	Sqr.	10.29	3,427	9.59	3,193	9.33	3,107	9.05	3,014	7.96	2,651
T. and G. spruce sheathing	135	M.B.M.	18.86	2,546	17.66	2,384	16.63	2,245	16.30	2,201	15.96	2,155
Slag roofing, ehrets	853	Sqr.	4.48	3,821	4 48	3,821	4.48	3,821	4.48	3,821	4 48	3,821
Skylights, duxbac ventilator	5,120	Sq. ft.	0.706	3,615	0.662	3,389	0.553	2,831	0.543	2,780	0 463	2,371
Steel rolling doors	14,607	Sq. ft.	0.6448	9,419	0.6124	8,945	0.5971	8,722	0.5828	8,513	0 5231	7,641
Windows, D. H.	320	Sq. ft.	0.24	77	0.22	70	0 22	70	0 22	70	0.19	61
Spruce nailing strips	13	M.B.M.	18.86	245	17.66	230	16.63	216	16.30	212	15 96	207
Y.P. framing	9	M.B.M.	19.31	174	19.31	174	18.19	164	17.82	160	17.46	157
W.I. pipe shoes	3,070	Lb.	0.0314	96	0 0279	86	0.0264	81	0.0242	74	0 0210	64
No. 20 gage galvanized leaders 5 in.	840	Lin. ft.	0.0862	72	0.0820	69	0.0802	67	0.0782	66	0.0706	59
Copper leader boxes	428	Sq. ft.	0 2314	99	0.1936	83	0.1636	70	0.1536	66	0.1466	63
No. 20 gage galvanized cornice	2,600	Sq. ft.	0 0721	187	0.0676	176	0.0656	171	0.0638	166	0 0563	146
Paint	180	Gal.	1.20	216	1.130	203	1.09	196	1.07	193	1.00	180
Hardware, rough	58	100 lb.	2.97	172	2.47	143	2.19	127	1.99	114	1.65	96
Ventilators, 24 in. star	10	Each	5.59	56	5.53	55	5.48	55	5.40	54	5.11	51
Total cost of material				$55,513		$51,375		$48,677		$46,315		$41,292
Laborer (building)	2,867	Hr.	$ 0.1612	462	$ 0.1630	467	$ 0.1627	466	$ 0.1616	463	$ 0.1615	463
Carpenter	2,368	Hr.	0.2923	692	0.2976	705	0.3019	715	0.3077	729	0.3034	718
Sheet metal worker	2,275	Hr.	0 2855	650	0.2972	676	0.2983	679	0.2984	679	0.2968	675
Painter	891	Hr.	0.2851	254	0.2874	256	0.2912	259	0.2962	264	0.2936	262
Total cost of labor				$ 2,058		$ 2,104		$ 2,119		$ 2,135		$ 2,118
Grand total				$57,571		$53,479		$50,796		$48,450		$43,410
Per cent of 1914 cost				118.09		109.70		104.19		99.38		89.04
Reciprocal				0.847		0.912		0.960		1.006		1.123

ESTIMATED AVERAGE COST OF A TYPICAL PIER SHED—STEEL FRAME—CORRUGATED IRON SIDING.—(*Continued*)

Item	Quantity	Unit	1895		1896		1897		1898		1899	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Structural steel	1,012,641	Lb.	$ 0.0240	$24,303	$ 0.0253	$25,620	$ 0.0221	$22,379	$ 0.0205	$20,759	$ 0.0306	$30,987
No. 20 gage corrugated galvanized iron	333	Sqr.	8.22	2,737	7.77	2,587	7.31	2,434	7.25	2,414	9.83	3,273
T. and G. spruce sheathing	135	M.B.M.	15.05	2,032	15.75	2,126	15.48	2,090	15.46	2,087	18.02	2,433
Slag roofing, ehrets	853	Sqr.	4.48	3,821	4.48	3,821	4.48	3,821	4.48	3,821	4.48	3,821
Skylights, duxbac ventilator	5,120	Sq. ft.	0.440	2,253	0.437	2,422	0.366	1,874	0.415	2,125	0.519	2,657
Steel rolling doors	14,607	Sq. ft.	0.5396	7,882	0.5181	7,568	0.4873	7,118	0.4903	7,162	0.6332	9,249
Windows, D.H.	320	Sq. ft.	0.17	54	0.16	51	0.16	51	0.18	58	0.23	74
Spruce nailing strips	13	M.B.M.	15.05	196	15.76	205	15.48	201	15.46	201	18.02	234
Y.P. framing	9	M.B.M.	16.46	148	17.22	155	16.93	152	16.91	152	19.71	177
W.I. pipe shoes	3,070	Lb.	0.0237	73	0.0249	76	0.0215	66	0.0202	62	0.301	92
No. 20 gage galvanized leaders 5 in.	840	Lin. ft.	0.0727	61	0.0700	59	0.0672	56	0.0665	56	0.0850	71
Copper leader boxes	428	Sq. ft.	0.1466	63	0.1467	63	0.1498	64	0.1437	62	0.2219	95
No. 20 gage galvanized cornice	2,600	Sq. ft.	0.0583	152	0.0553	144	0.0523	136	0.0516	134	0.0695	181
Paint	180	Gal.	1.01	182	0.91	164	0.91	164	0.95	171	1.01	182
Hardware, rough	58	100 lb.	2.12	123	2.93	170	1.49	86	1.44	84	2.39	139
Ventilators, 24 in. star	10	Each	5.20	52	5.18	52	5.11	51	5.07	51	5.84	58
Total cost of material				$44,132		$45,283		$40,743		$39,399		$53,723
Laborer (building)	2,867	Hr.	$ 0.1605	460	$ 0.1612	462	$ 0.1622	466	$ 0.1630	467	$ 0.1619	464
Carpenter	2,368	Hr.	0.2949	698	0.2970	703	0.2965	702	0.3068	727	0.3149	746
Sheet metal worker	2,275	Hr.	0.2995	681	0.3075	700	0.3141	715	0.3109	707	0.3211	731
Painter	891	Hr.	0.2923	260	0.2938	262	0.2941	262	0.2973	265	0.3051	272
Total cost of labor				$ 2,099		$ 2,127		$ 2,144		$ 2,166		$ 2,213
Grand total				$46,231		$47,410		$42,887		$41,565		$55,936
Per cent of 1914 cost				94.83		97.25		87.97		85.26		114.74
Reciprocal				1.055		1.028		1.137		1.173		0.872

ESTIMATED AVERAGE COST OF A TYPICAL PIER SHED—STEEL FRAME—CORRUGATED IRON SIDING.—(*Continued*)

Item	Quantity	Unit	1900		1901		1902		1903		1904	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Structural steel	1,012,641	Lb.	$ 0 0318	$32,202	$ 0.0265	$26,835	$ 0 0309	$31,291	$ 0.0277	$28,050	$ 0.0256	$25,924
No. 20 gage corrugated galvanized iron	333	Sqr.	10.13	3,373	10.83	3,606	9 77	3,253	8.64	2,877	7 55	2,514
T. and G. spruce sheathing	135	M.B.M.	20 46	2,762	17 97	2,426	19 00	2.565	19.84	2,678	20.13	2,718
Slag roofing, ehrets	853	Sqr.	4.48	3,821	4 48	3,821	4.48	3,821	4.48	3,821	4.48	3,821
Skylights, duxbac ventilator	5,120	Sq. ft.	0 544	2,785	0.532	2,724	0 455	2,330	0 558	2,857	0.439	2,248
Steel rolling doors	14,607	Sq. ft.	0.6574	9,603	0.6980	10,196	0 6579	9,610	0.5979	8,734	0.5412	7,905
Windows, D.H.	320	Sq. ft.	0 27	86	0 33	106	0 35	112	0 29	93	0 29	93
Spruce nailing strips	13	M.B.M.	20 46	266	17 97	234	19 00	247	19 84	258	20 13	262
Y.P. framing	9	M.B.M.	22 38	201	19 65	177	20 78	187	21 69	195	22 01	198
W.I. pipe shoes	3,070	Lb.	0 0227	70	0 0309	95	0 0301	92	0 0248	76	0 0233	72
No. 20 gage galvanized leaders 5 in	840	Lin. ft.	0.0884	75	0 0937	79	0 0876	74	0.0814	68	0.0739	62
Copper leader boxes	428	Sq ft.	0 2111	90	0 2132	91	0.1825	78	0.1968	84	0.1849	79
No. 20 gage galvanized cornice	2,600	Sq. ft.	0 0718	187	0 0765	199	0.0695	181	0 0622	162	0 0550	143
Paint	180	Gal.	1.210	218	1.150	207	1.090	196	1.09	196	1.06	190
Hardware, rough	58	100 lb.	2.63	153	2.37	137	2.10	122	2.08	121	1.91	111
Ventilators, 24 in. star	10	Each	6.15	62	6.44	64	6.40	64	6.39	64	6.14	61
Total cost of material				$55,954		$50,997		$54,223		$50,334		$46,401
Laborer (building)	2,867	Hr.	$ 0.1703	488	$ 0.1776	509	$ 0 1867	535	$ 0.1928	553	$ 0.1947	558
Carpenter	2,368	Hr.	0.3479	824	0 3614	856	0.3890	921	0.4135	979	0 4061	962
Sheet metal worker	2,275	Hr.	0.3420	778	0.3527	802	0.3760	855	0.4026	916	0.4059	923
Painter	891	Hr.	0.3176	283	0.3283	293	0.3466	309	0.3665	327	0.3775	336
Total cost of labor				$2,373		$ 2,460		$ 2,620		$ 2,775		$ 2,779
Grand total				$58,327		$53,457		$56,843		$53,109		$49,180
Per cent of 1914 cost				119.64		109.65		116.60		108 94		100.88
Reciprocal				0.836		0.912		0.858		0.918		0.991

ESTIMATED AVERAGE COST OF A TYPICAL PIER SHED—STEEL FRAME—CORRUGATED IRON SIDING.—(*Continued*)

Item	Quantity	Unit	1905		1906		1907		1908		1909	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Structural steel	1,012,641	Lb.	$ 0.0272	$27,544	$ 0.0285	$28,860	$ 0.0286	$28,962	$ 0.0280	$28,354	$ 0.0241	$24,405
No. 20 gage corrugated galvanized iron	333	Sqr.	7.90	2,631	8.22	2,737	8 72	2,904	8.290	2,761	7 81	2,601
T. and G. spruce sheathing	135	M.B.M.	21.15	2,855	26.63	3,595	26.92	3,634	24.31	3,282	23 07	3,114
Slag roofing, ehrets	853	Sqr	4.48	3,821	4 48	3,821	4.48	3,821	4.48	3,821	4.48	3,821
Skylights, duxbac ventilator	5,120	Sq. ft.	0.460	2,355	0.501	2,565	0.544	2,785	0.400	2,048	0.426	2,181
Steel rolling doors	14,607	Sq. ft.	0.5634	8,230	0.5849	8,544	0.6019	8,792	0.5915	8,640	0.5698	8,323
Windows, D.H.	320	Sq. ft.	0.31	99	0 31	99	0 33	106	0.31	99	0.31	99
Spruce nailing strips	13	M.B.M.	21.15	275	26 63	346	26.92	350	24.31	316	23.07	300
Y.P. framing	9	M.B.M.	23.13	208	29.13	260	29.44	265	26.59	239	25.23	227
W.I. pipe shoes	3,070	Lb.	0 0235	72	0.0235	72	0.0271	83	0.264	81	0.0216	66
No. 20 gage galvanized leaders 5 in.	840	Lin. ft.	0.771	65	0.0798	67	0.0832	70	0.0808	68	0.0781	66
Copper leader boxes	428	Sq. ft.	0.2040	87	0.2431	104	0.2841	122	0.1842	79	0.1843	79
No. 20 gage galvanized cornice	2,600	Sq. ft.	0 0573	149	0.0598	155	0.0632	164	0.0603	157	0.0572	149
Paint	180	Gal.	1.14	205	1.18	212	1.20	216	1.14	205	1.22	219
Hardware, rough	58	100 lb.	1.90	110	1.96	114	2.12	123	2.10	122	1.92	111
Ventilators, 24 in. star	10	Each	6.35	64	6.51	65	6.62	66	6.62	66	6.62	66
Total cost of material				$48,770		$51,616		$52,463		$50,338		$45,827
Laborer (building)	2,867	Hr.	$ 0 1931	554	$ 0 2028	581	$ 0.2255	647	$ 0.2276	653	$ 0.2391	685
Carpenter	2,368	Hr.	0.4265	1,010	0.4412	1,045	0 4647	1,100	0.4656	1,103	0.4765	1,128
Sheet metal worker	2,275	Hr.	0.4179	951	0.4250	967	0.4241	965	0.4343	988	0.4450	1,012
Painter	891	Hr.	0.3879	346	0.3979	355	0.4145	369	0.4195	374	0.4248	378
Total cost of labor				$ 2,861		$ 2,948		$ 3,081		$ 3,118		$ 3,203
Grand total				$51,631		$54,564		$55,544		$53,456		$49,030
Per cent of 1914 cost				105 91		111.92		113 93		109 65		100.57
Reciprocal				0.944		0.893		0.878		0.912		0.994

ESTIMATED AVERAGE COST OF A TYPICAL PIER SHED—STEEL FRAME—CORRUGATED IRON SIDING.—(*Continued*)

Item	Quantity	Unit	1910		1911		1912		1913		1914	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Structural steel	1,012.641	Lb.	$ 0.0248	$25,113	$ 0.0229	$23,189	$ 0.0229	$23,189	$ 0.0253	$25,620	$ 0.0233	$23,595
No. 20 gage corrugated galvanized iron	333	Sqr.	7.90	2,631	7.14	2,378	7.18	2,391	7.70	2,564	7.33	2,441
T. and G. spruce sheathing	135	M.B.M.	23.48	3,170	23.95	3,233	24.84	3,353	25.63	3,460	23.93	3,230
Slag roofing, ehrets	853	Sqr.	4.48	3,821	4.48	3,821	4.48	3,821	4.03	3,438	4.87	4,154
Skylights, duxbac ventilator	5,120	Sq. ft.	0.467	2,391	0.435	2,227	0.478	2,447	0.498	2,550	0.457	2,340
Steel rolling doors	14,607	Sq. ft.	0.5794	8,463	0.5411	7,904	0.5483	8.009	0.5851	8,547	0.5413	7,907
Windows, D.H.	320	Sq. ft.	0.31	99	0.28	90	0.27	86	0.29	93	0.29	93
Spruce nailing strips	13	M.B.M.	23.48	305	23.95	311	24.84	323	25.63	333	23.93	311
Y.P. framing	9	M.B.M.	25.67	231	26.20	236	27.16	244	28.03	252	26.17	236
W.I. pipe shoes	3,070	Lb.	0.0213	65	0.0185	57	0.0200	61	0.0206	63	0.0200	57
No. 20 gage galvanized leaders 5 in.	840	Lin. ft.	0.0797	67	0.0747	63	0.0758	64	0.0807	68	0.0753	63
Copper leader boxes	428	Sq. ft.	0.1856	79	0.1716	73	0.2188	94	0.2181	93	0.1943	83
No. 20 gage galvanized cornice	2,600	Sq. ft.	0.0579	151	0.0528	137	0.0533	139	0.0571	148	0.0509	132
Paint	180	Gal.	1.45	261	1.500	270	1.33	239	1.20	216	1.23	221
Hardware, rough	58	100 lb.	1.89	110	1.800	104	1.74	101	1.82	106	1.68	97
Ventilators, 24 in. star	10	Each	6.81	68	6.68	67	6.83	68	7.23	72	7.20	72
Total cost of material				$47,025		$44,160		$44,629		$47,623		$45,032
Laborer (building)	2,867	Hr.	$ 0.2439	699	$ 0.2476	710	$ 0.2591	743	$ 0.2633	755	$ 0.2798	802
Carpenter	2,368	Hr.	0.4951	1,172	0.5000	1,184	0.5094	1,206	0.5223	1,237	0.5376	1,273
Sheet metal worker	2,275	Hr.	0.4625	1,052	0.4670	1,062	0.4810	1,094	0.5060	1,151	0.5267	1,198
Painter	891	Hr.	0.4419	393	0.4575	408	0.4685	417	0.4862	433	0.5019	447
Total cost of labor				$ 3,317		$ 3,364		$ 3,460		$ 3,576		$ 3,720
Grand total				$50,342		$47,524		$48,089		$51,199		$48,752
Per cent of 1914 cost				103.26		97.48		98.64		105 02		100.00
Reciprocal				0.968		1.026		1.014		0.952		1.000

ESTIMATED AVERAGE COST OF A TYPICAL PIER SHED—STEEL FRAME—CORRUGATED IRON SIDING.—(*Continued*)

Item	Quantity	Unit	1915		1916		1917		1918		1919	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Structural steel	1,012,641	Lb.	$ 0.0237	$24,000	$ 0.0401	$40,607	$ 0.0470	$47,594	$ 0.0433	$43,847	$ 0.0343	$34,734
No. 20 gage corrugated galvanized iron	333	Sqr.	8.61	2,867	11.07	3,686	18.05	6,011	14.43	4,805	13.37	4,452
T. and G. spruce sheathing	135	M.B.M.	22.83	3,082	26.95	3,638	33.41	4,510	41.06	5,543	49.97	6,746
Slag roofing, ehrets	853	Sqr.	5.02	4,282	6.07	5,178	7.03	5,997	8.05	6,867	10.58	9,025
Skylights, duxbac ventilator	5,120	Sq. ft.	0.477	2,442	0.696	3,564	0.771	3,948	0.750	3,840	0.797	4,081
Steel rolling doors	14,607	Sq. ft.	0.6449	9,420	0.7797	11,389	1.1644	17,008	0.9984	14,583	0.9769	14,270
Windows, D.H.	320	Sq. ft.	0.29	93	0.32	102	0.39	125	0.51	163	0.63	202
Spruce nailing strips	13	M.B.M.	22.83	297	26.95	350	33 41	434	41 06	534	49.97	650
Y.P. framing	9	M.B.M.	24.97	225	29.47	265	36.53	329	44.91	404	54.64	492
W.I. pipe shoes	3,070	Lb.	0.0213	65	0.0302	93	0 0474	146	0.0466	143	0.431	132
No. 20 gage galvanized leaders 5 in.	840	Lin. ft.	0.0888	75	0.1063	89	0.1561	131	0.1354	114	0.1338	112
Copper leader boxes	428	Sq ft.	0.2314	99	0.3655	156	0.3978	170	0.3458	148	0.2940	126
No. 20 gage galvanized cornice	2,600	Sq. ft.	0.0636	165	0.0805	209	0.1285	334	0.1047	272	0.0987	254
Paint	180	Gal.	1.290	232	1.68	302	2.12	382	2 610	470	2.82	508
Hardware, rough	58	100 lb.	1.75	102	2.60	151	3 63	211	3.60	209	3.52	204
Ventilators, 24 in. star	10	Each	7.77	78	8.47	85	10 54	105	10.46	105	11.21	112
Total cost of material				$47,524		$69,864		$87,435		$82,047		$76,100
Laborer (building)	2,867	Hr.	$ 0.2760	791	$ 0.3124	896	$ 0 3607	1,034	$ 0.4659	1,336	$ 0.5391	1,546
Carpenter	2,368	Hr.	0.5491	1,300	0.5653	1,339	0.6213	1,471	0.6784	1,606	0.7786	1,844
Sheet metal worker	2,275	Hr.	0.5362	1,220	0.5424	1,234	0.5661	1,288	0.6492	1,477	0.7471	1,700
Painter	891	Hr.	0.5028	448	0.5325	474	0.5617	500	0.6465	576	0.7402	660
Total cost of labor				$ 3,759		$ 3,943		$ 4,293		$ 4,995		$ 5,750
Grand total				$51,283		$73,807		$91,728		$87,042		$81,850
Per cent of 1914 cost				105.19		151.39		188.15		178.54		167.89
Reciprocal				0.951		0.661		0.531		0.560		0.596

ESTIMATED AVERAGE COST OF A TYPICAL PIER SHED—STEEL FRAME—CORRUGATED IRON SIDING.—(*Continued*)

Item	Quantity	Unit	1920		1921		1922		1923	
			Unit price	Amount	Unit price	Amount	Unit price	Amount	Unit price	Amount
Structural steel	1,012,641	Lb.	$ 0.0380	$38,480	$ 0.0278	$28,151	$ 0.0282	$28,556	$ 0 0354	$35,847
No. 20 gage corrugated galvanized iron	333	Sqr.	16 69	5,558	11 26	3,750	10 16	3,383	11 24	3,743
T. and G. spruce sheathing	135	M.B.M.	59 11	7,980	45 78	6,180	45 78	6,180	49 61	6,697
Slag roofing, ehrets	853	Sqr.	12 23	10,517	11 65	9,937	11 65	9,937	12 54	10,697
Skylights, duxbac ventilator	5,120	Sq. ft.	0 823	4,214	0 703	3,599	0 709	3,630	0 858	4,393
Steel rolling doors	14,607	Sq. ft.	1 2382	18,086	0 9553	13,954	0 8580	12,533	0 9662	14,113
Windows, D.H.	320	Sq. ft.	0 89	285	0 63	202	0 64	205	0 76	243
Spruce nailing strips	13	M.B.M.	59 11	768	45 78	595	45 78	595	49 61	645
Y.P. framing	9	M.B.M.	64 64	582	50 06	451	50 06	451	54 25	488
W.I. pipe shoes	3,070	Lb.	0 0466	143	0 0380	117	0 0321	99	0 364	112
No. 20 gage galvanized leaders 5 in	840	Lin. ft.	0 1700	143	0 1327	111	0 1193	100	0 1345	113
Copper leader boxes	428	Sq. ft.	0 2957	127	0 2164	93	0 2141	92	0 2458	105
No. 20 gage galvanized cornice	2,600	Sq. ft.	0 1241	323	0 0864	225	0 0775	202	0 0865	225
Paint	180	Gal.	3 02	544	2 20	396	2 19	394	2 26	407
Hardware, rough	58	100 lb.	4 20	244	3 07	178	2 53	147	2 92	169
Ventilators, 24 in. star	10	Each	14 45	145	13 61	136	12 23	122	14 00	140
Total cost of material				$88,139		$68,075		$66,626		$78,137
Laborer (building)	2,867	Hr.	$ 0 6967	1,997	$ 0 6871	1,970	$ 0 5027	1,441	$ 0 6312	1,810
Carpenter	2,368	Hr.	1 0268	2,431	1 0679	2,529	0 9582	2,269	1 0866	2,573
Sheet metal worker	2,275	Hr.	0 9750	2,218	1 0304	2,344	0 9240	2,102	1 0669	2,427
Painter	891	Hr.	1 0000	891	1 0339	921	0 9175	817	1 0330	920
Total cost of labor				$ 7,537		$ 7,764		$ 6,629		$ 7,730
Grand total				$95,676		$75,839		$73,255		$85,867
Per cent of 1914 cost				196.25		155.56		150.26		176.13
Reciprocal				0.510		0.643		0.666		0.568

Estimated Average Cost of a Typical Reinforced Concrete Warehouse Building

Item	Quantity	Unit	1900		1901	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 1.89	$ 26,768.64	$ 1.62	$ 22,944.55
Lime (300 lb. bbl.)	212.69	Bbl.	0.71	151.01	0.80	170.15
Sand	4,007.14	Cu. yd.	0.82	3,285.85	0.85	3,406.07
Stone	6,771.37	Cu. yd.	0.82	5,552.52	0.85	5,755.66
Cinders	763.00	Cu. yd.	0.41	312.83	0.43	328.09
Brick, common	475.30	M. brk	5.80	2,756.74	6.34	3,013.40
Brick, face	108.12	M. brk.	20.95	2,265.11	20.99	2,269.44
Stone trim	2,197.00	Cu. ft.	0.88	1,933.36	0.88	1,933.36
Terra cotta hollow tile	87.29	Tons	7.00	611.03	7.15	624.12
Roofing, pitch and gravel	174.62	Sqr.	4.48	782.30	4.48	782.30
Structural steel	1,522.4	Cwt.	3.18	4,841.23	2.65	4,034.36
Y.P. flooring (sheet piling)	10.65	M.B M.	31.28	333.13	27.05	288.08
Sheathing and boarding (form wk.)	416.00	M.B.M.	20.46	8,511.36	17.97	7,475.52
Simple framing, Oak	3.12	M.B.M.	22.38	69.83	19.65	61.31
Nails	243.73	Kegs	2.63	641.01	2.37	577.64
Doors, tin clad	4,048.00	Sq. ft.	0.466	1,886.37	0.464	1,878.27
Doors, wood	270.00	Sq. ft.	0.30	81.00	0.35	94.50
Windows, wood	405.00	Sq. ft.	0.27	109.35	0.33	133.65
Steel sash, glazed	19,360.00	Sq. ft.	0.434	8,402.24	0.481	9,312.16
Miscellaneous iron	8,933.28	Cwt.	3.14	28,050.50	3.22	28,765.16
Wrought iron	156.27	Cwt.	3.14	490.69	3.22	503.19
Cast iron	4,076.00	Lb.	0.029	118.20	0.028	114.13
Skylights, G.I.	270.00	Sq. ft.	0.414	111.78	0.406	109.62
Copper flashing, 16 oz.	17.57	Sqr.	21.11	370.90	21.32	374.59
Ventilators, G.I.	6.00	No.	6.15	36.90	6.44	38.64
Paint, lead and oil	615.22	Gal.	1.21	744.42	1.15	707.50
Paint, cold water	168.30	Cwt.	1.24	208.69	1.41	237.30
Total cost of material				$ 99,426.99		$ 95,932.76
Engineers, hoist, mixer	1,760.0	Hr.	$ 0.50	880.00	$ 0.50	880.00
Excavating	10,580.7	Cu. yd.	0.201	2,126.72	0.208	2,200.79
Cartage	10,580.7	Cu. yd.	0.183	1,936.27	0.189	1,999.75
Common labor	163,572.0	Hr.	0.170	27,807.24	0.178	29,115.82
Bricklayers	8,203.0	Hr.	0.473	3,880.02	0.509	4,175.33
Hod carriers	8,525.0	Hr.	0.260	2,216.50	0.264	2,250.60
Cement finishers	4,870.0	Hr.	0.366	1,782.42	0.386	1,879.82
Plasterer	534.0	Hr.	0.439	234.43	0.466	248.84
Carpenter	45,489.0	Hr.	0.348	15,830.17	0.361	16,421.53
Sheet metal worker	175.0	Hr.	0.342	59.85	0.353	61.78
Ornamental iron worker	2,032.0	Hr.	0.305	619.76	0.357	725.42
Painter	4,448.0	Hr.	0.318	1,414.46	0.328	1,458.94
Plant, concrete	100.0	Days	17.00	1,700.00	17.00	1,700.00
Total cost of labor				$ 60,487.84		$ 63,118.62
Grand total				$159,914.83		$159,051.38
Per cent of 1914 cost				79.23		78.80
Reciprocal				1.262		1.269

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1902		1903	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 1.68	$ 23,794.34	$ 1.76	$ 24,927.41
Lime (300 lb. bbl.)	212.69	Bbl.	0.84	178.66	0.82	174.41
Sand	4,007.14	Cu. yd.	0.88	3,526.28	0.88	3,526.28
Stone	6,771.37	Cu. yd.	0.88	5,958.81	0.88	5,958.81
Cinders	763.00	Cu. yd.	0.43	328.09	0.44	335.72
Brick, common	475.30	M. brk.	5.99	2,847.05	6.53	3,103.71
Brick, face	108.12	M. brk.	21.43	2,317.01	22.69	2,453.24
Stone trim	2,197.00	Cu. ft.	0.88	1,933.36	0.88	1,933.36
Terra cotta hollow tile	87.29	Tons	7.15	624.12	7.25	632.85
Roofing, pitch and gravel	174.62	Sqr.	4.48	782.30	4.48	782.30
Structural steel	1,522.4	Cwt.	3.09	4,704.22	2.77	4,217.05
Y.P. flooring (sheet piling)	10.65	M.B.M.	28.63	304.91	29.52	314.39
Sheathing and boarding (form wk.)	416.00	M.B.M.	19.00	7,904.00	19.84	8,253.44
Simple framing	3.12	M.B.M.	20.78	64.83	21.69	67.67
Nails	243.73	Kegs	2.10	511.83	2.08	506.96
Doors, tin clad	4,048.00	Sq. ft.	0.502	2,032.10	0.516	2,088.77
Doors, wood	270.00	Sq. ft.	0.39	105.30	0.33	89.10
Windows, wood	405.00	Sq. ft.	0.35	141.75	0.29	117.45
Steel sash, glazed	19,360.00	Sq. ft.	0.484	9,370.24	0.466	9,021.76
Miscellaneous iron	8,933.28	Cwt.	3.67	32,785.14	3 61	32,249.14
Wrought iron	156.27	Cwt.	3.67	573.51	3.61	564.13
Cast iron	4,076.00	Lb.	0.033	134.51	0.035	142.66
Skylights, G.I.	270.00	Sq. ft.	0.351	94.77	0.432	116.64
Copper flashing, 16 oz	17.57	Sqr.	18.25	320.65	19.68	345.78
Ventilators, G.I.	6.00	No.	6.40	38.40	6.39	38.34
Paint, lead and oil	615.22	Gal.	1.09	670.59	1.09	670.59
Paint, cold water	168.30	Cwt.	1.46	245.72	1.42	238.99
Total cost of material				$102,292.49		$102,870.95
Engineers, hoist, mixer	1,760.0	Hr.	$ 0.50	880.00	$ 0.50	880.00
Excavating	10,580.7	Cu. yd.	0.214	2,264.27	0.216	2,285.43
Cartage	10,580.7	Cu. yd.	0.195	2,063.24	0.197	2,084.40
Common labor	163,572.0	Hr.	0.187	30,587.96	0.193	31,569.40
Bricklayers	8,203.0	Hr.	0.543	4,454.23	0.564	4,626.49
Hod carriers	8,525.0	Hr.	0.279	2,378.48	0.295	2,514.88
Cement finishers	4,870.0	Hr.	0.420	2,045.40	0.445	2,167.15
Plasterer	534.0	Hr.	0.496	264.86	0.527	281.42
Carpenter	45,489.0	Hr.	0.389	17,695.22	0.414	18,832.45
Sheet metal worker	175.0	Hr	0.376	65.80	0.403	70.53
Ornamental iron worker	2,032.0	Hr.	0.397	806.70	0.415	843.28
Painter	4,448.0	Hr.	0.347	1,543.46	0.366	1,627.97
Plant, concrete	100.0	Days	17.00	1,700.00	17.00	1,700 00
Total cost of labor				$ 66,749.62		$ 69,483.40
Grand total				$169,042.11		$172,354.35
Per cent of 1914 cost				83.75		85.39
Reciprocal				1.194		1.171

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1904		1905	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$1.19	$ 16,854.33	$ 1.16	$ 16,429.43
Lime (300 lb. bbl.)	212.69	Bbl.	0.86	182.91	0.92	195.67
Sand	4,007.14	Cu. yd.	0.89	3,566.35	0.89	3,566.35
Stone	6,771.37	Cu. yd.	0.89	6,026.52	0.89	6,026.52
Cinders	763.00	Cu. yd.	0.44	335.72	0.43	328.09
Brick, common	475.30	M. brk.	8.13	3,864.19	8.73	4,149.37
Brick, face	108.12	M. brk.	23.31	2,520.28	22.69	2,453.24
Stone trim	2,197.00	Cu. ft.	0.88	1,933.36	0.88	1,933.36
Terra cotta hollow tile	87.29	Tons	7.30	637.22	7.05	615.39
Roofing, pitch and gravel	174.62	Sqr.	4.48	782.30	4.48	782.30
Structural steel	1,522 4	Cwt.	2.56	3,897 34	2.72	4,140.93
Y.P. flooring (sheet piling)	10.65	M.B.M.	30.03	319.82	31.65	337.07
Sheathing and boarding (form wk.)	416.00	M.B.M.	20.13	8,374.08	21.15	8,798.40
Simple framing	3.12	M.B.M.	22.01	68 67	23.13	72.17
Nails	243.73	Kegs	1.91	465.52	1.90	463.09
Doors, tin clad	4,048 00	Sq. ft.	0.515	2,084.72	0.559	2,262.83
Doors, wood	270.00	Sq. ft.	0.32	86.40	0.36	97.20
Windows, wood	405.00	Sq. ft.	0.29	117.45	0.31	125.55
Steel sash, glazed	19,360.00	Sq. ft.	0.483	9,350.88	0.483	9,350.88
Miscellaneous iron	8,933.28	Cwt.	3.48	31,087.81	3.74	33,410.47
Wrought iron	156.27	Cwt.	3.48	543.82	3.74	584.45
Cast iron	4,076.00	Lb.	0.029	118.20	0.033	134.51
Skylights, G.I.	270.00	Sq. ft.	0.316	85.32	0.321	86.67
Copper flashing, 16 oz.	17.57	Sqr.	18.49	324.87	20.40	358.43
Ventilators, G.I.	6.00	No.	6.14	36.84	6.35	38.10
Paint, lead and oil	615.22	Gal.	1.06	652.13	1.14	701.35
Paint, cold water	168.30	Cwt.	1.50	252.45	1.61	270.96
Total cost of material				$ 94,569 50		$ 97,712.78
Engineers, hoist, mixer	1,760.0	Hr.	$ 0.50	880 00	$ 0.50	880.00
Excavating	10,580.7	Cu. yd.	0.217	2,296.01	0.217	2,296.01
Cartage	10,580.7	Cu. yd.	0.198	2,094.98	0.199	2,105.56
Common labor	163,572.0	Hr.	0.195	31,896.54	0.193	31,569.40
Bricklayers	8,203.0	Hr.	0.568	4,659.30	0.594	4,872.58
Hod carriers	8,525.0	Hr.	0.293	2,497 83	0.296	2,523 40
Cement finishers	4,870.0	Hr.	0.471	2,293.77	0.476	2,318.12
Plasterer	534.0	Hr.	0.544	290.50	0.565	301.71
Carpenter	45,489.0	Hr.	0.406	18,468.53	0.426	19,378.31
Sheet metal worker	175.0	Hr.	0.406	71.05	0.418	73.15
Ornamental iron worker	2,032.0	Hr.	0.453	920 50	0.468	950.98
Painter	4,448.0	Hr.	0.378	1,681.34	0.388	1,725.82
Plant, concrete	100.0	Days	17.00	1,700.00	17.00	1,700.00
Total cost of labor				$ 69,750.35		$ 70,695.04
Grand total				$164,319.85		$168,407.82
Per cent of 1914 cost				81.41		83.44
Reciprocal				1.228		1.198

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1906		1907	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 1 38	$ 19,545.35	$ 1.46	$ 20,678.42
Lime (300 lb. bbl.)	212.69	Bbl.	0.98	208.44	0.99	210.56
Sand	4,007.14	Cu. yd.	0.95	3,806.78	0.99	3,967.07
Stone	6,771 37	Cu yd.	0.95	6,432.80	0.99	6,703.66
Cinders	763.00	Cu. yd.	0 44	335.72	0.44	335.72
Brick, common	475.30	M. brk.	9.21	4,377 51	6.89	3,274.82
Brick, face	108.12	M. brk.	21.62	2,337 55	21.24	2,296.47
Stone trim	2,197.00	Cu. ft.	1 03	2,262 91	1 04	2,284.88
Terra cotta hollow tile	87.29	Tons	6 90	602 30	7.05	615.39
Roofing, pitch and gravel	174 62	Sqr.	4 48	782 30	4 48	782.30
Structural steel	1,522 4	Cwt.	2 85	4,338.84	2.86	4,354.06
Y.P. flooring (sheet piling)	10 65	M.B.M.	40 50	431.33	40 84	434.95
Sheathing and boarding (form wk.)	416 00	M.B.M.	26.63	11,078.08	26.92	11,198.72
Simple framing	3.12	M.B.M.	29.13	90.89	29.44	91.85
Nails	243.73	Kegs	1.96	477.71	2.12	516.71
Doors, tin clad	4,048 00	Sq. ft.	0.608	2,461.18	0.623	2,521.90
Doors, wood	270.00	Sq. ft.	0.35	94.50	0.37	99.90
Windows, wood	405.00	Sq. ft.	0.31	125.55	0.33	133.65
Steel sash, glazed	19,360 00	Sq. ft.	0 493	9,544.48	0.494	9,563.84
Miscellaneous iron	8,933.28	Cwt.	3.78	33,767.80	3.97	35,465.12
Wrought iron	156.27	Cwt.	3.78	590.70	3.97	620.39
Cast iron	4,076.00	Lb.	0.038	154.89	0.039	158.96
Skylights, G I	270.00	Sq. ft.	0.325	87.75	0.331	89.37
Copper flashing, 16 oz	17.57	Sqr.	24.31	427.13	28.41	499.16
Ventilators, G.I	6.00	No.	6.51	39.06	6.62	39.72
Paint, lead and oil	615.22	Gal.	1.18	725.96	1.20	738.26
Paint, cold water	168.30	Cwt.	1.72	289.48	1.72	289.48
Total cost of material				$105,416.99		$107,965.33
Engineers, hoist, mixer	1,760.0	Hr.	$ 0.50	880.00	$ 0.50	880.00
Excavating	10,580.7	Cu yd.	0.218	2,306.59	0.209	2,211.37
Cartage	10,580.7	Cu. yd.	0.209	2,211.37	0.214	2,264.27
Common labor	163,572 0	Hr	0.203	33,205 12	0.226	36,967.27
Bricklayers	8,203.0	Hr.	0.604	4,954.61	0.607	4,979.22
Hod carriers	8,525.0	Hr.	0.304	2,591.60	0.316	2,693.90
Cement finishers	4,870.0	Hr.	0.490	2,386.30	0.550	2,678.50
Plasterer	534.0	Hr.	0.5.6	312.92	0.603	322.00
Carpenter	45,489.0	Hr.	0.441	20,060.65	0.465	21,152.39
Sheet metal worker	175.0	Hr.	0.425	74.38	0.424	74.20
Ornamental iron worker	2,032.0	Hr.	0.463	940.82	0.480	975.36
Painter	4,448.0	Hr.	0.398	1,770.30	0.414	1,841.47
Plant, concrete	100.0	Days	17.00	1,700.00	17 00	1,700.00
Total cost of labor				$ 73,394.66		$ 78,739.95
Grand total				$178,811.65		$186,705.28
Per cent of 1914 cost				88.59		92.50
Reciprocal				1.129		1.081

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1908		1909	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 1.27	$ 17,987.39	$ 1.23	$ 17,420.86
Lime (300 lb. bbl.)	212.69	Bbl.	1.08	229.71	1.08	229.71
Sand	4,007.14	Cu. yd.	1.09	4,367.78	1.09	4,367.78
Stone	6,771.37	Cu. yd.	1.09	7,380.79	1.09	7,380.79
Cinders	763.00	Cu. yd.	0.45	343.35	0.46	350.98
Brick, common	475.30	M. brk.	5.84	2,775.75	7.16	3,403.15
Brick, face	108.12	M. brk.	21.25	2,297.55	22.73	2,457.57
Stone trim	2,197.00	Cu. ft.	1.04	2,284.88	1.19	2,614.43
Terra cotta hollow tile	87.29	Tons	6.55	571.75	6.90	602.30
Roofing, pitch and gravel	174.62	Sqr.	4.48	782.30	4.48	782.30
Structural steel	1,522.4	Cwt.	2.80	4,262.72	2.41	3,668.98
Y.P. flooring (sheet piling)	10.65	M.B.M.	35.88	382.12	33.11	352.62
Sheathing and boarding (form wk.)	416.00	M.B.M.	24 31	10,112.96	23.07	9,597.12
Simple framing	3.12	M.B.M.	26.59	82.96	25.23	78.72
Nails	243.73	Kegs	2.10	511.83	1.92	467.96
Doors, tin clad	4,048.00	Sq. ft.	0.610	2,469.28	0.595	2,408.56
Doors, wood	270.00	Sq. ft.	0.36	97.20	0.36	97.20
Windows, wood	405.00	Sq. ft.	0.31	125.55	0.31	125.55
Steel sash, g azed	19,360.00	Sq. ft	0.482	9,331 52	0.486	9,408 96
Miscellaneous iron	8,933.28	Cwt.	3.63	32,427.81	3.73	33,321.13
Wrought iron	156.27	Cwt.	3.63	567.26	3.73	582.89
Cast iron	4,076.00	Lb.	0.031	126.36	0.031	126.36
Skylights, G.I.	270.00	Sq. ft.	0.284	76.68	0.306	82 62
Copper flashing, 16 oz.	17.57	Sqr.	18.42	323.64	18.43	323 82
Ventilators, G.I.	6.00	No.	6.62	39.72	6.62	39.72
Paint, lead and oil	615.22	Gal.	1.14	701.35	1.22	750.57
Paint, cold water	168.30	Cwt.	1.89	318.09	1.89	318.09
Total cost of material				$100,978.30		$101,360.74
Engineers, hoist, mixer	1,760.0	Hr.	$ 0.50	880.00	$ 0.50	880.00
Excavating	10,580.7	Cu. yd.	0.208	2,200.79	0.194	2,052.66
Cartage	10,580.7	Cu. yd.	0.234	2,475.89	0.230	2,433.56
Common labor	163,572.0	Hr.	0.228	37,294.42	0.239	39,093.71
Bricklayers	8,203 0	Hr.	0.612	5,020.24	0.616	5,053.05
Hod carriers	8,525 0	Hr.	0.319	2,719.48	0.323	2,753.58
Cement finishers	4,870.0	Hr.	0.551	2,683.37	0.555	2,702.85
Plasterer	534.0	Hr.	0.594	317.20	0.606	323.60
Carpenter	45,489.0	Hr.	0.466	21,197.87	0.476	21,652.76
Sheet metal worker	175.0	Hr.	0.434	75.95	0.445	77.88
Ornamental iron worker	2,032.0	Hr.	0.498	1,011.94	0.507	1,030 22
Painter	4,448.0	Hr.	0.420	1,868.16	0.425	1,890.40
Plant, concrete	100.0	Days	17.00	1,700.00	20.00	2,000.00
Total cost of labor				$ 79,445.31		$ 81,944.27
Grand total				$180,423.61		$ 183,305.01
Per cent of 1914 cost				89.39		90.82
Reciprocal				1.119		1.101

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1910		1911	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 1.26	$ 17,845.76	$ 1.20	$ 16,995.96
Lime (300 lb. bbl.)	212.69	Bbl.	1.08	229.71	1.15	244.59
Sand	4,007.14	Cu. yd.	1.16	4,648.28	1.16	4,648.28
Stone	6,771.37	Cu. yd.	1.16	7,854.79	1.16	7,854.79
Cinders	763.00	Cu. yd.	0.47	358.61	0.47	358.61
Brick, common	475.30	M. brk.	6.51	3,094.20	6.70	3,184.51
Brick, face	108.12	M. brk.	22.15	2,394.86	19.94	2,155.91
Stone trim	2,197.00	Cu. ft.	1.19	2,614.43	1.19	2,614.43
Terra cotta hollow tile	87.29	Tons	7.10	619.76	7.05	615.39
Roofing, pitch and gravel	174.62	Sqr.	4.48	782.30	4.48	782.30
Structural steel	1,522.4	Cwt.	2.48	3,775.55	2.29	3,486.30
Y.P. flooring (sheet piling)	10.65	M.B.M.	33.90	361.04	34.90	371.69
Sheathing and boarding (form wk.)	416.00	M.B.M.	23.48	9,767.68	23.95	9,963.20
Simple framing	3.12	M.B.M.	25.67	80.09	26.20	81.74
Nails	243.73	Kegs	1.89	460.65	1.80	438.71
Doors, tin clad	4,048.00	Sq. ft	0.615	2,489.52	0.569	2,303.31
Doors, wood	270.00	Sq ft.	0.36	97.20	0.31	83.70
Windows, wood	405.00	Sq. ft.	0.31	125.50	0.28	113.40
Steel sash, glazed	19,360.00	Sq. ft.	0.513	9,931.68	0.492	9,525.12
Miscellaneous iron	8,933.28	Cwt.	3.83	34,214.46	3.64	32,517.14
Wrought iron	156.27	Cwt.	3.83	598.51	3.64	568.82
Cast iron	4,076.00	Lb.	0.029	118.20	0.026	105.98
Skylights, G.I.	270.00	Sq. ft.	0.347	93.69	0.323	87.21
Copper flashing, 16 oz.	17.57	Sqr.	18.56	326.10	17.16	301.50
Ventilators, G.I.	6.00	No.	6.81	40.86	6.68	40.08
Paint, lead and oil	615.22	Gal.	1.45	892.07	1.50	922.83
Paint, cold water	168.30	Cwt.	1.89	318.09	2.00	336.60
Total cost of material				$104,133.59		$100,702.10
Engineers, hoist, mixer	1,760.0	Hr.	$ 0.50	880.00	$ 0.50	880.00
Excavating	10,580.7	Cu. yd.	0.179	1,893.95	0.179	1,893.95
Cartage	10,580.7	Cu. yd.	0.238	2,518.21	0.238	2,518.21
Common labor	163,572.0	Hr.	0.244	39,911.57	0.248	40,565.86
Bricklayers	8,203.0	Hr.	0.629	5,159.69	0.629	5,159.69
Hod carriers	8,525.0	Hr.	0.332	2,830.30	0.336	2,864.40
Cement finishers	4,870.0	Hr.	0.564	2,746.68	0.566	2,756.42
Plasterer	534.0	Hr.	0.622	332.15	0.627	334.82
Carpenter	45,489.0	Hr.	0.495	22,517.06	0.500	22,744.50
Sheet metal worker	175.0	Hr.	0.462	80.85	0.467	81.73
Ornamental iron worker	2,032.0	Hr.	0.510	1,036.32	0.514	1,044.44
Painter	4,448.0	Hr.	0.442	1,966.02	0.458	2,037.18
Plant, concrete	100.0	Days	20.00	2,000.00	20.00	2,000.00
Total cost of labor				$ 83,872.80		$ 84,881.20
Grand total				$188,006.39		$185,583.30
Per cent of 1914 cost				93.15		91.95
Reciprocal				1.074		1.088

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1912		1913	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 1.06	$ 15,013.10	$ 1.32	$ 18,695.56
Lime (300 lb. bbl.)	212.69	Bbl.	1.13	240 34	1.12	238 21
Sand	4,007.41	Cu. yd.	1.22	4,888.71	1.24	4,968.85
Stone	6,771 37	Cu. yd.	1.22	8,261 07	1.24	8,396.50
Cinders	763.00	Cu. yd	0.48	366 24	0 48	366.24
Brick, common	475.30	M. brk.	7.60	3,612 28	7 64	3,631.29
Brick, face	108.12	M. brk	24.66	2,666 24	24.68	2,668.40
Stone trim	2,197.00	Cu. ft.	1.19	2,614.43	1.19	2,614.43
Terra cotta hollow tile	87.29	Tons	7.20	628.49	7.80	680.86
Roofing, pitch and gravel	174 62	Sqr.	4 48	782.30	4 03	703 72
Structural steel	1,522.4	Cwt.	2.29	3,486.30	2.53	3,851.67
Y.P. flooring (sheet piling)	10.65	M.B.M.	36.00	383 40	35 12	374.03
Sheathing and boarding (form wk.)	416.00	M.B.M.	24.84	10,333.44	25 63	10,662 08
Simple framing	3.12	M.B.M.	27.16	84.74	28.03	87.45
Nails	243.73	Kegs	1.74	424.09	1.82	443.58
Doors, tin clad	4,048.00	Sq. ft.	0.584	2,364 03	0.604	2,444.99
Doors, wood	270.00	Sq. ft.	0.30	81.00	0.31	83 70
Windows, wood	405.00	Sq. ft.	0.27	109.35	0.29	117.45
Steel sash, glazed	19,360.00	Sq. ft.	0.526	10,183 36	0.546	10,570.56
Miscellaneous iron	8,933.28	Cwt.	3.85	34,393.13	4.17	37,251.78
Wrought iron	156.27	Cwt.	3.85	601.64	4.17	651.65
Cast iron	4,076.00	Lb.	0.027	110.05	0.028	114.13
Skylights, G.I.	270.00	Sq. ft.	0.319	86.13	0.344	92.88
Copper flashing, 16 oz.	17.57	Sqr.	21.88	384.43	21.81	383.20
Ventilators, G.I.	6.00	No.	6.83	40.98	7.23	43.38
Paint, lead and oil	615.22	Gal.	1.33	818.24	1.20	738.26
Paint, cold water	168.30	Cwt.	1.96	329.87	1.94	326.50
Total cost of material				$103,287.38		$111,201.35
Engineers, hoist, mixer	1,760.0	Hr.	$ 0.50	880 00	$ 0.625	1,100.00
Excavating	10,580.7	Cu. yd	0.183	1,936.27	0.193	2,042.07
Cartage	10,580.7	Cu. yd.	0.253	2,676.92	0.257	2,719.24
Common labor	163,572.0	Hr.	0.259	42,365 15	0 263	43,019.44
Bricklayers	8,203.0	Hr	0.636	5,217.11	0.659	5,405.78
Hod carriers	8,525.0	Hr.	0.340	2,898.50	0.345	2,941.12
Cement finishers	4,870.0	Hr.	0.570	2,775.90	0.592	2,883.04
Plasterer	534.0	Hr.	0.631	336.95	0.650	347.10
Carpenter	45,489.0	Hr.	0.509	23,153.90	0.522	23,745.26
Sheet metal worker	175.0	Hr.	0.481	84.18	0.506	88.55
Ornamental iron worker	2,032 0	Hr.	0.542	1,101 34	0.580	1,178.56
Painter	4,448.0	Hr.	0.468	2,081.66	0.486	2,161.73
Plant, concrete	100.0	Days	20.00	2,000.00	20.00	2,000.00
Total cost of labor				$ 87,507.88		$ 89,631.89
Grand total				$190,795.26		$200,833.24
Per cent of 1914 cost				94.53		99.51
Reciprocal				1.058		1.005

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1914		1915	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 1.32	$ 18,695.56	$ 1.19	$ 16,854.33
Lime (300 lb. bbl.)	212.69	Bbl	1.07	227.58	1.28	272.24
Sand	4,007.14	Cu. yd.	1.25	5,008 93	1.27	5,089.07
Stone	6,771.37	Cu. yd.	1.25	8,464.21	1.27	8,599.64
Cinders	763 00	Cu. yd.	0.48	366.24	0.50	381.50
Brick, common	475.30	M. brk.	7 05	3,350 87	7.05	3,350.87
Brick, face	108.12	M. brk.	21 73	2,349 45	22.32	2,413.24
Stone tr m	2,197 00	Cu ft.	1.20	2,636 40	1.20	2,636.40
Terra cotta hollow tile	87 29	Tons	7.30	637.22	7.45	650.31
Roofing, pitch and gravel	174 62	Sqr.	4.87	850 40	5.02	876.59
Structural steel	1,522 4	Cwt.	2.33	3,547 19	2 37	3,608.09
Y.P. flooring (sheet piling)	10.65	M.B.M.	30.43	324.08	30.28	322.48
Sheathing and boarding (form wk.)	416.00	M.B.M.	23 93	9,954 88	22 83	9,497.28
Simple framing	3.12	M.B.M.	26 17	81 65	24.97	77.91
Nails	243.73	Kegs	1 68	409.47	1.75	426.53
Doors, tin clad	4,048 00	Sq. ft.	0.599	2,424 75	0.616	2,493.57
Doors, wood	270 00	Sq. ft.	0.31	83 70	0.32	86.40
Windows, wood	405.00	Sq. ft.	0.29	117 45	0.29	117.45
Steel sash, glazed	19,360 00	Sq. ft.	0.550	10,648 00	0 630	12,196 80
Miscellaneous iron	8,933.28	Cwt.	4.00	35,733 12	4.15	37,073 11
Wrought iron	156.27	Cwt.	4 00	625 08	4 15	648.52
Cast iron	4,076.00	Lb.	0 025	101 90	0 028	114.13
Skylights, G.I.	270.00	Sq. ft.	0.320	86 40	0 317	85 59
Copper flashing, 16 oz.	17.57	Sqr.	19.43	341 39	23.14	406 57
Ventilators, G.I.	6 00	No.	7 20	43 20	7 77	46.62
Paint, lead and oil	615.22	Gal.	1 23	756 72	1 29	793.63
Paint, cold water	168 30	Cwt.	1.85	311.36	2 24	376.99
Total cost of material				$108,177.20		$109,495.86
Engineers, hoist, mixer	1,760 0	Hr.	$ 0 625	1,100.00	$ 0 .65	1,144 00
Excavating	10,580.7	Cu. yd.	0 194	2,052.66	0.199	2,105 56
Cartage	10,580 7	Cu. yd.	0 260	2,750 98	0.263	2,782.72
Common labor	163,572 0	Hr.	0 280	45,800 16	0.276	45,145 87
Bricklayers	8,203 0	Hr.	0 674	5,528 82	0.683	5,602.65
Hod carriers	8,525 0	Hr.	0 350	2,983 75	0.352	3,000 80
Cement finishers	4,870 0	Hr.	0 620	3,019 40	0.630	3,068 10
Plasterer	534 0	Hr.	0 659	351 91	0.669	357 25
Carpenter	45,489 0	Hr.	0 538	24,473 08	0.549	24,973 46
Sheet metal worker	175 0	Hr.	0 527	92 23	0.536	93 80
Ornamental iron worker	2,032 0	Hr.	0 621	1,261 87	0.621	1,261.87
Painter	4,448 0	Hr.	0 502	2,232 90	0.503	2,237.34
Plant, concrete	100.0	Days	20 00	2,000 00	22.00	2,200 00
Total cost of labor				$ 93,647.76		$ 93,973.42
Grand total				$201,824.96		$203,469.28
Per cent of 1914 cost				100.00		100.81
Reciprocal				1.000		0.992

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1916		1917	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$1.44	$ 20,395.15	$ 1.85	$ 26,202.11
Lime (300 lb. bbl.)	212.69	Bbl.	1.45	308.40	1.82	387.10
Sand	4,007.14	Cu. yd.	1.35	5,409.64	1.56	6,251.14
Stone	6,771.37	Cu yd.	1.35	9,141.35	1.56	10,563.34
Cinders	763.00	Cu. yd.	0.51	389.13	0.55	419.65
Brick, common	475.30	M. brk.	8.41	3,997.27	9.83	4,672.20
Brick, face	108.12	M brk.	23.52	2,542.98	23.97	2,591.64
Stone trim	2,197.00	Cu. ft.	1.30	2,856.10	1.31	2,878.07
Terra cotta hollow tile	87.29	Tons	8.65	755.06	9 35	816.17
Roofing, pitch and gravel	174.62	Sqr.	6.07	1,059.94	7.03	1,227.58
Structural steel	1,522.4	Cwt.	4.01	6,104.82	4.70	7,155.28
Y.P. flooring (sheet piling)	10.65	M.B.M.	38.55	410 56	50.03	532.82
Sheathing and boarding (form wk.)	416.00	M.B.M.	26 95	11,211 20	33.41	13,898.56
Simple framing	3.12	M.B.M.	29.47	91 95	36.53	113.97
Nails	243.73	Kegs	2.60	633 70	3.63	884.74
Doors, tin clad	4,048.00	Sq. ft.	0.741	2,999 57	0.976	3,950.85
Doors, wood	270.00	Sq. ft.	0.36	97 20	0.44	118.80
Windows, wood	405.00	Sq. ft.	0.32	129 60	0.39	157.95
Steel sash, glazed	19,360.00	Sq. ft	0.911	17,636.96	1.324	25,632.64
Miscellaneous iron	8,933.28	Cwt.	5.73	51,187.69	7.23	64,587.61
Wrought iron	156.27	Cwt.	5.73	895.43	7.23	1,129.83
Cast iron	4,076.00	Lb.	0.038	154.89	0.066	269.02
Skylights, G.I.	270.00	Sq. ft.	0.422	113.94	0.519	140.13
Copper flashing, 16 oz.	17.57	Sqr.	36.55	642.18	39.78	698.93
Ventilators, G.I.	6.00	No.	8.47	50.82	10.54	63.24
Paint, lead and oil	615.22	Gal.	1.68	1,033.57	2.12	1,304.27
Paint, cold water	168.30	Cwt.	2.54	427.48	3.18	535.19
Total cost of material				$140,676.58		$177,182.83
Engineers, hoist, mixer	1,760.0	Hr.	$ 0.65	1,144.00	$0.70	1,232.00
Excavating	10,580.7	Cu. yd.	0.204	2,158.46	0.24	2,539.37
Cartage	10,580.7	Cu. yd.	0.280	2,962 60	0.32	3,385.82
Common labor	163,572.0	Hr.	0.312	51,034.46	0.361	59,049.49
Bricklayers	8,203.0	Hr.	0.691	5,668.27	0.736	6,037.41
Hod carriers	8,525.0	Hr.	0.372	3,171.30	0.421	3,589.03
Cement finishers	4,870.0	Hr.	0.636	3,097 32	0.671	3,267.77
Plasterer	534.0	Hr.	0.683	364 72	0.713	380.74
Carpenter	45,489 0	Hr.	0.565	25,701.29	0.621	28,248.67
Sheet metal worker	175.0	Hr.	0.542	94 85	0.566	99.05
Ornamental iron worker	2,032.0	Hr.	0.633	1,286.26	0.682	1,385.82
Painter	4,448.0	Hr.	0.532	2,366.34	0.562	2,499.78
Plant, concrete	100.0	Days	22.00	2,200.00	24.00	2,400.00
Total cost of labor				$101,249.87		$114,114.95
Grand total				$241,926.45		$291,297.78
Per cent of 1914 cost				119.86		144.33
Reciprocal				0.834		0.693

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1918		1919	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 2.27	$ 32,150.69	$ 2.73	$ 38 665.80
Lime (300 lb. bbl.)	212.69	Bbl.	2.38	506.20	2.76	587.02
Sand	4,007.14	Cu. yd.	1.87	7,493.35	2.01	8,054.35
Stone	6,771.37	Cu. yd.	1.87	12,662.46	2.01	13.610.45
Cinders	763.00	Cu yd.	0.69	526.47	0.75	572.25
Brick, common	475.30	M. brk.	13.95	6,630.44	16.23	7,714.12
Brick, face	108.12	M. brk.	29.39	3,177.65	34.63	3,744.20
Stone trim	2,197.00	Cu. ft.	1.33	2,922.01	1.74	3,822.78
Terra cotta hollow tile	87.29	Tons	15.20	1,326 81	14.30	1,248.25
Roofing, pitch and gravel	174.62	Sqr.	8.05	1,405.69	10.58	1,847.48
Structural steel	1,522.4	Cwt.	4.33	6,591.99	3.43	5,221.83
Y.P. flooring (sheet piling)	10.65	M B.M.	64.09	682.56	72.27	769.68
Sheathing and boarding (form wk.)	416.00	M.B.M.	41.06	17,080 96	49.97	20,787.52
Simple framing	3.12	M.B M.	44.91	140.12	54.64	170.48
Nails	243.73	Kegs	3.60	877.43	3.52	857.93
Doors, tin clad	4,048.00	Sq. ft.	1.096	4,436.61	1.169	4,732.11
Doors, wood	270.00	Sq. ft.	0.55	148.50	0.69	186.30
Windows, wood	405.00	Sq. ft.	0.51	206.55	0.63	255.15
Steel sash, glazed	19,360.00	Sq. ft.	1.571	30,414.56	1.666	32,253.76
Miscellaneous iron	8,933.28	Cwt.	7.59	67,803 60	7.15	63,872.95
Wrought iron	156.27	Cwt.	7.59	1,186 09	7.15	1,117.33
Cast iron	4,076.00	Lb.	0.073	297.55	0.069	281.24
Skylights, G.I.	270.00	Sq. ft.	0.523	141.21	0.614	165.78
Copper flashing, 16 oz.	17.57	Sqr.	34.58	607 57	29.40	516.56
Ventilators, G.I	6.00	No.	10.46	62.76	11.21	67.26
Paint, lead and oil	615.22	Gal.	2.61	1,605.72	2.82	1,734.91
Paint, cold water	168.30	Cwt.	4.18	703.49	4.83	812.89
Total cost of material				$201,789.04		$213,670.38
Engineers, hoist, mixer	1,760.0	Hr.	$ 0.80	1,408.00	$ 0.90	1,584.00
Excavating	10,580.7	Cu. yd.	0.27	2,856.79	0.30	3,174.21
Cartage	10,580.7	Cu. yd.	0.39	4,126.47	0.42	4,443.89
Common labor	163,572.0	Hr.	0.466	76,224.55	0.539	88,165.31
Bricklayers	8,203.0	Hr.	0.794	6,513.18	0.904	7,415.51
Hod carriers	8,525.0	Hr.	0.501	4,271.03	0.601	5,123.53
Cement finishers	4,870.0	Hr.	0.729	3,550.23	0.823	4,008 01
Plasterer	534.0	Hr.	0.747	398.90	0.868	463 51
Carpenter	45,489.0	Hr.	0.678	30,841.54	0.779	35,435.93
Sheet metal worker	175.0	Hr.	0.649	113.58	0.747	130.73
Ornamental iron worker	2,032.0	Hr.	0.784	1,593.09	0.879	1,786 13
Painter	4,448.0	Hr.	0.646	2,873.41	0.740	3,291.52
Plant, concrete	100.0	Days	26.00	2,600.00	26.00	2,600.00
Total cost of labor				$137,370.77		$157,622.28
Grand total				$339,159.81		$371,292.66
Per cent of 1914 cost				168.04		183.96
Reciprocal				0.595		0.544

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1920		1921	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 3.44	$ 48,721.75	$ 2.67	$ 37,816.01
Lime (300 lb. bbl.)	212.69	Bbl.	3.78	803.97	3.92	833.74
Sand	4,007.14	Cu. yd.	3.01	12,061.49	2.62	10,498.71
Stone	6,771.37	Cu. yd.	3.01	20,381.82	2.62	17,740.99
Cinders	763.00	Cu. yd.	0.98	747.74	0.98	747.74
Brick, common	475.30	M. brk.	25.06	11,911.02	20.32	9,658.10
Brick, face	108.12	M. brk.	39.12	4,229.65	41.49	4,485.90
Stone trim	2,197.00	Cu. ft.	1.86	4,086.42	1.86	4,086.42
Terra cotta hollow tile	87.29	Tons	20.00	1,745.80	15.40	1,344.27
Roofing, pitch and gravel	174.62	Sqr.	12.33	2,153.06	11.65	2,034.32
Structural steel	1,522.4	Cwt.	3.80	5,785.12	2.78	4,232.27
Y.P. flooring (sheet piling)	10.65	M.B M.	32.04	873.73	64.24	684.16
Sheathing and boarding (form wk.)	416.00	M.B.M.	59 11	24,589 76	45 78	19,044 48
Simple framing	3.12	M.B.M.	64.64	201.68	50.06	156.19
Nails	243.73	Kegs	4.20	1,023.67	3.07	748.25
Doors, tin clad	4,048.00	Sq. ft.	1.619	6,553.71	1.276	5,165.25
Doors, wood	270.00	Sq. ft.	1.03	278.10	0.68	183.60
Windows, wood	405.00	Sq. ft.	0.89	360.45	0.63	255.15
Steel sash, glazed	19,360.00	Sq. ft.	1.986	38,448.96	1.793	34,712.48
Miscellaneous iron	8,933.28	Cwt.	9.03	80,667.52	7.23	64,587.61
Wrought iron	156.27	Cwt.	9.03	1,411.12	7.23	1,129.83
Cast iron	4,076.00	Lb.	0.089	362.76	0.066	269.02
Skylights, G.I.	270.00	Sq. ft.	0.667	180.09	0.585	157.95
Copper flashing, 16 oz.	17.57	Sqr.	29.57	519.54	21.64	380.21
Ventilators, G.I.	6.00	No.	14.45	86.70	13.61	81.66
Paint, lead and oil	615.22	Gal.	3.02	1,857.96	2.20	1,353.48
Paint, cold water	168.30	Cwt.	6.63	1,115.83	6.88	1,157.90
Total cost of material				$271,159.42		$223,545.69
Engineers, hoist, mixer	1,760.0	Hr.	$ 1.125	1,980.00	$ 1.125	1,980.00
Excavating	10,580.7	Cu. yd.	0.38	4,020.67	0.35	3,703.25
Cartage	10,580.7	Cu. yd.	0.62	6,560.03	0.54	5,713.58
Common labor	163,572.0	Hr.	0.697	114,009.68	0.687	112,373.96
Bricklayers	8,203.0	Hr.	1.166	9,564.70	1.227	10,065.08
Hod carriers	8,525.0	Hr.	0.786	6,700 65	0.802	6,837.05
Cement finishers	4,870.0	Hr.	1.091	5,313.17	1.154	5,619.98
Plasterer	534.0	Hr.	1.124	600.22	1.241	662.69
Carpenter	45,489.0	Hr.	1.027	46,717.20	1.068	48,582.25
Sheet metal worker	175.0	Hr.	0.975	170.63	1.030	180.25
Ornamental iron worker	2,032.0	Hr.	1.100	2,235.20	1.098	2,231.14
Painter	4,448.0	Hr.	1.000	4,448.00	1.034	4,599.23
Plant, concrete	100.0	Days	28.00	2,800.00	28.00	2,800.00
Total cost of labor				$205,120.15		$205,348.46
Grand total				$476,279.57		$428,894.15
Per cent of 1914 cost				235.98		212.50
Reciprocal				0.424		0.471

ESTIMATED AVERAGE COST OF A TYPICAL REINFORCED CONCRETE WAREHOUSE BUILDING.—(*Continued*)

Item	Quantity	Unit	1922		1923	
			Unit price	Amount	Unit price	Amount
Cement	14,163.30	Bbl.	$ 2.36	$ 33,425.39	$ 2.50	$ 35,408.25
Lime (300 lb. bbl.)	212.69	Bbl.	3.94	838.00	4.01	852.89
Sand	4,007.14	Cu. yd.	2.22	8,895.85	2.77	11,099.78
Stone	6,771.37	Cu. yd.	2.22	15,032.44	2.77	18,756.69
Cinders	763.00	Cu. yd.	0.87	663.81	0.90	686.70
Brick, common	475.30	M. brk.	18.34	8,717.00	21.27	10,109.63
Brick, face	108.12	M. brk.	40.11	4,336.69	38.97	4,213.44
Stone trim	2,197.00	Cu. ft.	1.73	3,800.81	1.85	4,064.45
Terra cotta hollow tile	87.29	Tons	13.40	1,169.69	13.40	1,169.69
Roofing, pitch and gravel	174.62	Sqr.	11.65	2,034.32	12.54	2,189.73
Structural steel	1,522.4	Cwt.	2.82	4,293.17	3.54	5,389.29
Y.P. flooring (sheet piling)	10.65	M.B.M.	69.84	743.79	79.60	847.74
Sheathing and boarding (form wk)	416.00	M.B.M.	45.78	19,044.48	49.61	20,637.76
Simple framing	3.12	M.B.M.	50.06	156.19	54.25	169.26
Nails	243.73	Kegs	2.53	616.64	2.92	711.69
Doors, tin clad	4,048.00	Sq. ft.	1.192	4,825.22	1.365	5,525.52
Doors, wood	270.00	Sq. ft.	0.75	202.50	0.90	243.00
Windows, wood	405.00	Sq. ft.	0.64	259.20	0.76	307.80
Steel sash glazed	19,360.00	Sq. ft.	1.981	38,352.16	2.299	44,508.64
Miscellaneous iron	8,933.28	Cwt	6.48	57,887.65	7.57	67,624.93
Wrought iron	156.27	Cwt.	6.48	1,012.62	7.57	1,182.96
Cast iron	4,076.00	Lb.	0.055	224.18	0.072	293.47
Skylights, G.I	270.00	Sq. ft.	0.583	157.41	0.711	191.97
Copper flashing, 16 oz.	17.57	Sqr.	21.41	376.17	24.58	431.87
Ventilators, G.I.	6.00	No.	12.23	73.38	14.00	84.00
Paint, lead and oil	615.22	Gal.	2.19	1,347.33	2.26	1,390.40
Paint, cold water	168.30	Cwt.	6.97	1,173.05	7.07	1,189.88
Total cost of material				$209.659.14		$239,281.43
Engineers, hoist, mixer	1,760.0	Hr.	$ 1.00	1,760.00	$ 1.04	1,830.40
Excavating	10,580.7	Cu. yd.	0.33	3,491.63	0.36	3,809.05
Cartage	10,580.7	Cu. yd.	0.44	4,867.12	0.53	5,607.77
Common labor	163,572.0	Hr.	0.503	82,276.72	0.631	103,213.93
Bricklayers	8,203.0	Hr.	1.167	9,572.90	1.325	10,868.97
Hod carriers	8,525.0	Hr.	0.672	5,728.80	0.845	7,203.62
Cement finishers	4,870.0	Hr.	1.024	4,986.88	1.156	5,629.72
Plasterer	534.0	Hr.	1.144	610.90	1.357	724.64
Carpenter	45,489.0	Hr.	0.958	43,578.46	1.087	49,446.54
Sheet metal worker	175.0	Hr.	0.924	161.70	1.067	186.72
Ornamental iron worker	2,032.0	Hr.	0.998	2,027.94	1.099	2,233.17
Painter	4,448.0	Hr.	0.918	4,083.26	1.033	4,594.78
Plant, concrete	100.0	Days	30.00	3,000.00	30.00	3,000.00
Total cost of labor				$166,146.31		$198,349.31
Grand total				$375,805.45		$437,630.74
Per cent of 1914 cost				186.20		216.83
Reciprocal				0.537		0.461

Cost of Reinforced Concrete Warehouse Building Including Plumbing, Heating, Lighting and Elevators, 1900–1922

Year	Total cost of structure proper	Cost of plumbing	Cost of heating	Cost of lighting	Cost of elevators	Grand total cost	Per cent of 1914 cost	Reciprocal
1900	$159,914.83	$ 6,771.05	$12,698.71	$ 8,946.03	$44,918.25	$233,248.87	85.85	1.165
1901	159,051.38	6,685.74	13,085.01	8,946.03	44,499.84	232,268.00	85.49	1 170
1902	169,042.11	6,755.87	14,391.41	8,946.03	46,917.74	246,053.16	90.56	1.104
1903	172,354.35	6,973.50	14,243.91	8,946.03	42,319.30	244,837.09	90.11	1.110
1904	164,319.85	6,905.53	12,996.52	8,946.03	39,744.50	232,912.43	85.72	1.166
1905	168,407.82	7,037.12	13,905.37	8,779.18	36,880.03	235,309.52	86.61	1.155
1906	178,811.65	7,222.22	15,156.98	9,807.76	38,927.81	249,926.42	91.99	1,087
1907	186,705.28	7,567.82	16,109.39	9,833.62	39,647.95	259,864.06	95,64	1.046
1908	180,423.61	7,233.80	15,200.53	9,617.56	38,730.67	251,206.17	92.46	1.082
1909	183,305.01	7,010.37	13,999.48	9,041.96	38,090.99	251,447.81	92.55	1.080
1910	188,006.39	7,285.12	13,847.78	9,090.34	39,137.01	257,366.64	94.72	1.056
1911	185,583.30	7,106.53	13,572.45	8,634.03	38,710.56	253,606.87	93.34	1.071
1912	190,795.26	7,232.34	14,145.58	8,601.50	39,543.34	260,318.02	95.81	1.044
1913	200,833.24	7,353.08	14,644.26	8,755.83	41,269.27	272,855.68	100.42	0.996
1914	201,824.96	7,230.17	14,047.25	8,342.06	40,231.30	271,675.74	100.00	1.000
1915	203,469.28	7,450.69	14,360.50	8,472.48	42,299.19	276,322.14	101.70	0.983
1916	241,926.45	7,989.34	18,182.76	9,852.81	50,550.63	328,501.99	120.91	0.827
1917	291,297.78	9,078.20	24,453.45	10,757.09	56,219.22	391,805.74	144.20	0.693
1918	339,159.81	9,254.62	28,382.47	11,906.62	60,962.49	449,666.01	165.50	0.604
1919	371,292.66	9,783.14	25,365.12	14,443.44	63,147.05	484,031.41	178.15	0.561
1920	476,279.57	13,764.80	30,610.36	15,129.16	74,512.39	610,296.28	224.62	0.445
1921	428,894.15	15,400.26	26,096.98	13,226.34	69,370.83	552,988.56	203.53	0.491
1922	356,793.96	14,704.00	22,890.00	11,633.00	65,050.00	471,070.96	173.38	0.577
1922	375,805.45	14,844.99	23,603.59	11,633.00	66,168.42	492,055.45	181.12	0.552
1923	437,630.74	16,230.29	27,942.79	13,124.56	73,985.36	568,913.74	209.41	0.478

CHAPTER XXIX

DEPRECIATION

The general method of handling the subject of depreciation is determined to a large degree by the purpose for which the presentation is prepared. Most of the writings on this subject have been to show how depreciation should be handled in case of public service corporations, the earnings of which are, to a greater or less degree, fixed by law. These writers have gone very thoroughly into the question of whether or not in the valuation of such companies, depreciation should be taken into account, and if it should be assumed to exist, how the records should be kept, and how the wasting assets should be made good. In comparatively few instances have these writers tried to show how the actual depreciation in any given case should be figured.

In this chapter, public service companies have not been kept especially in mind, but rather the man who wishes to buy or sell real estate, or the man or company having a factory, shop, office, or other business requiring the use of buildings, machinery, plant, etc., and who when figuring his income tax wishes to make the proper reduction from his gross receipts to take care of the depreciation in his buildings and plant. Such an owner will also need to know the depreciation of his property as one of the elements to assist him in determining the amount of fire insurance which he should carry.

Methods of Estimating Depreciation.—There are a number of ways of considering depreciation and the way to be chosen depends largely on the use that is to be made of it. For instance, the sale value of many articles takes a sudden drop as soon as they are put in use, and after that their value goes down very slowly. While on the other hand, from an upkeep standpoint the reverse would be true. In the case of a building there is but little upkeep required for the first few years, after which it will increase as time goes on. There are likewise a number of methods of determining the depreciation, all of which are more or less approximate. Some of the more common methods are—"The Straight Line Method," "Reducing Balance

Method," "Sinking Fund Method," "Equal Annual Payment Method," and the "Unit Cost Method." Each one no doubt has its good points, but the "Straight Line Method" is probably as accurate as any and the most simple to understand and use. It is free from interest complications and its use does not require any difficult mathematical calculations. Therefore it is the only method used in this chapter.

The "Straight Line Formula" can be stated as follows: Let V represent the investment, n the average life period in years, S the salvage value, and X the amount that is to be annually charged off for depreciation, and we have—

$$X = \frac{V - S}{n}$$

If the salvage value is zero, the formula becomes—

$$X = \frac{V}{n}$$

Illustration: assume the case of a building to cost \$1,000. Life of 25 yr. and the salvage value of zero, and we have—

$$X = \frac{\$1{,}000}{25} = \$40.$$ Annual depreciation to be charged.

Principal Causes of Depreciation.

Natural decay
Wear and tear
Obsolescence
Inadequacy.

In the case of buildings, machinery, plants, etc., these four usually go on together, and each has some share in causing the final removal of the item in question. Where the first two items are the principal cause of depreciation, it is not difficult to figure with a fair degree of accuracy an average reasonable life, nor is it at all impossible to estimate the expected life when either one or both of the others are active to a reasonable degree. However, if obsolescence or inadequacy becomes the determining factor as in the case of machinery that while practically new and able to perform its expected work with 100 per cent efficiency is discarded because of the invention of better machinery, or if in the case of a building constructed but a few years, and which is found inadequate for a growing business, or for the accommodations of new machinery. It is evident that such instances

cannot be taken care of by a general rule but must be treated as individual cases and the depreciation figured for the known conditions.

How Long Do Buildings Last?—In the Interstate Commerce Commission's valuation of steam railroads in the United States, buildings are depreciated by the straight line method on the general assumption that the average life of a frame building is 50 yr., and of a masonry building 100 yr. Of course after a field inspection they have made various exceptions to this rule. The Federal authorities which have charge of the figuring of income taxes, do not specify length of life but permit depreciation on buildings to be figured by various amounts ranging from 1 up to 16⅔ per cent per year, depending on construction, use, etc. This would be equivalent to saying that the life of a building will vary between 6 and 100 yr.

Almost any person who has passed middle age, when asked how long a building will last, will at once commence to enumerate a number of buildings with which he is familiar that have been in use for a long time and are still in good shape, but will probably say nothing about hundreds of buildings which were just as well constructed that he had seen torn down while comparatively new.

There is no doubt that in rural communities, especially in those that are making little or no growth, buildings do last much longer than they do in our cities and live factory towns. The reason for this is that in the former case there is but little wear and tear, obsolescence does not worry their owners and there is no inadequacy. It is therefore to be understood that any rules given in this chapter are for buildings in cities or towns that are alive and growing.

Personal Observation.—The author has made a study of thousands of railroad buildings and is now making a careful investigation as to their average life, and while this study has not progressed far enough to give final conclusions, it has been ascertained that in the past, with the rapid advance of first-class roads, the average life of frame buildings, due partially of course to inadequacy, has not been much, if any, over 30 yr., and that of masonry buildings, 40 yr. Through the tendency of any business gradually to reach a more stable state, the change, while continuing, becomes more gradual, and it may be that the buildings recently constructed by the various railroads will have a much longer life than mentioned above. In fact, there is little reason to doubt that this will be the case. It is, however, entirely possible that new inventions, new kinds of

machinery, new sources of power, etc. may revolutionize industrial plants and make those now existing either obsolete or inadequate, but in spite of this possibility, an average life table for a variety of buildings has been formulated to assist those who must of necessity figure their depreciation for both buildings and plant, and to enable them to arrive not at theories but at dollars and cents.

The intelligent use of any rule for depreciation presupposes a careful field inspection and the full knowledge of the conditions surrounding the building, machinery, etc. on which the depreciation is to be figured. It is also assumed that the rules will be applied by one familiar with the subject of depreciation and who will use reasonable judgment.

Conditions to be Observed—Field Inspection.—The first question to be considered is the kind of construction, whether the building is of stone, concrete, brick, tile, frame, corrugated iron, etc., and the second, which is equally important, is whether the construction is of first, second or third class. For instance a wall of a building constructed of granite, well dressed and laid in portland cement mortar should be good indefinitely, *i.e.* from a finite point of view. On the other hand the brown stone fronts which were so popular on Fifth Avenue, New York City, some 25 yr. ago, which were sawed out of stone with a decided grain and set on edge, soon crumbled and fell apart, and most of them have already been replaced by a more durable material. The same condition existed with limestone from certain quarries in the middle west, which in place of growing harder after being taken from the quarry, had a tendency to slake and crumble to pieces within a short time. There is also a vast difference in the life of buildings of first-class construction and those of a lower grade, whether of masonry or frame. The former will usually last twice as long as the latter. The use and location of buildings also have a material effect on their life. The fumes of certain chemicals shorten the life of most building materials and the rigor of our northern winters hastens the disintegration of buildings especially when of second-class construction.

Scrap or Salvage Value of Buildings.—When a building has served its purpose and must be removed, it is rarely worth more than the cost of tearing down and removing, and not infrequently, where the removal is to be done quickly, as is often the case, the scrap value is not sufficient to pay for the work of wrecking. It is of course per-

fectly possible in most cases to continue to repair a building and so keep it in use almost indefinitely.

It does not seem desirable to continue the depreciation down to a zero point without it is known that the building is to be demolished or abandoned, but rather to fix arbitrarily a point at say 10 per cent, 25 per cent or even a greater per cent of the original cost below which the depreciation shall not go, it being the policy of the company owning the building to keep the condition of their buildings up to at least this point. While the building is maintained at this level, the supposition is that the repairs from time to time exactly average the depreciation, and therefore the building remains in a constant condition.

Tables of Depreciation.—The following "Life Tables" are suggestive and are in the main taken from various decisions of the Interstate Commerce Commission and Courts together with information from books, articles, etc. by acknowledged authorities on the subject. In some instances certain classes of buildings have been put into two groups, as under certain conditions they might fall in either. In almost every instance, the depreciation per cent falls within the limits, and usually not far from the average which is permitted by the Federal Government in figuring depreciation for income tax purposes.

LIFE TABLES

100-yr. Table—1 Per Cent

Only when obsolescence and inadequacy are not the controlling features

Museums	Masonry	First class
School houses	Masonry	First class
Churches	Masonry	First class
Dwellings	Masonry	First class
State houses	Masonry	First class

50-yr. Table—2 Per Cent

Obsolescence and inadequacy play their usual part as in a growing business in an up-to-date community

School buildings	Stone or brick	First class
Banks	Masonry	First class
Offices	Masonry	First class
Power plants	Masonry	First class
Dwellings	Masonry	First class
Dwellings	Frame	First class
Factories	Masonry	First class
Churches	Masonry	First class

40-YR. TABLE—2½ PER CENT

Academies	Masonry	Without dormitories
Hotels	Masonry	First class
Stores	Masonry	First class
Elevators, grain	Masonry	First class
Mill buildings	Masonry	First class

33½-YR. TABLE—3 PER CENT

Apartment houses	Masonry	Second class
Barns	Brick	First class
Academies	Brick	With dormitories
Hotels	Masonry	Second class
Offices	Masonry	Second class
Chimneys	Masonry	First class
Churches	Frame	First class
Dwellings	Frame	First class

25-YR. TABLE—4 PER CENT

Obsolescence and inadequacy play their usual part as in a growing business in an up-to-date community

Factory buildings	Frame	First class
Factory buildings	Brick	Second class
Car barns	Brick	Second class
Car barns	Frame	First class
Hotels	Frame	First class
Power plants	Masonry	Second class
Stores	Masonry	Second class
Elevators, grain	Frame	First class

20-YR. TABLE—5 PER CENT

Factory buildings	Frame	Second class
Tenement houses	Frame	Second class
Stores	Frame	Second class

15-YR. TABLE—6⅔ PER CENT

Steel stacks

10-YR. TABLE—10 PER CENT

Portable buildings
Small frame buildings built on ground

DEPRECIATION OF MACHINERY

It should be kept in mind that the total service life of a machine is not a definite fixed quantity, but rather is dependent on a variety of conditions. Its life can be prolonged by good housing, by being properly cleaned and oiled, by being used by competent and careful workman, and by light service use. On the other hand the service life will be shortened by poor housing by lack of cleaning, oiling, etc., as well as by being used beyond its capacity and by lack of needed repairs or proper maintenance. The proper service life of a machine can therefore be determined only after the conditions under which it is operating are ascertained by careful inspection. In the case of a machine which has been in use longer than the average life of a machine of its kind, it is well to fix a minimum value at or a little above the minimum service condition below which it should not be depreciated.

The service condition per cent of a machine is the ratio of the expected service remaining in such a machine to the total anticipated service when new. In the case of machines, the major parts of which are of different ages, it is desirable to determine one service condition per cent for the entire composite machine. This can be done by properly weighting the several parts, by estimating their approximate value, and by multiplying each weight by its age and dividing the sum of the results thus obtained by the total weight.

The following table is by no means complete but is intended to cover a sufficient number of machines so that any other which is not given can easily be compared to some similar machine in the list, and in this way its average life and depreciation estimated.

This list has been taken largely from a list prepared and used by the Interstate Commerce Commission, Division of Valuation, Western District. Certain changes, however, have been made in order to conform more closely to the decisions of the Collector of Internal Revenue in connection with income tax returns. The table shows what is assumed to be the extreme range of service life, the average service life, the average annual depreciation and the recommended minimum service condition per cent.

NORMAL SERVICE LIFE AND DEPRECIATION OF MACHINERY

Class of machinery	Years life service range			Annual depreciation, per cent	Minimum service condition, per cent
	From	To	Average		
Anvils (Field inspection)					
Blower, pressure	10	20	15	6.67	20
Bender, pipe	15	25	10	5.00	20
Brake, sheet metal	20	30	25	4.00	20
Boiler, fire tube	10	25	18	5.56	25
Boiler, water tube	20	33⅓	25	4.00	25
Compressor, air—steam drive	15	25	20	5.00	25
Compressor, air—electric drive	15	25	20	5.00	25
Compressor, air—belt drive	20	30	25	4.00	25
Cutter, bolt or stay bolt	15	25	20	5.00	20
Cutter, pipe	15	20	17½	5.71	20
Cutter, gear	25	35	30	3.33	20
Crane, traveling	10	15	20	5.00	20
Crane, hand traveling, metal	20	50	35	2.86	20
Conveyor, coal or ash	10	20	15	6.67	20
Drill press, upright	15	30	22½	4.44	20
Drill press, radial	15	30	22½	4.44	20
Drill, arch bar, or multiple	20	40	30	3.33	20
Engine, corliss—slow speed	25	35	30	3.33	25
Engine, auto. four valve riding cut off, med. speed	20	30	25	4.00	25
Engine, auto. self oiling high speed.	15	25	20	5.00	25
Engine, plain slide valve vertical or horizontal, med. speed	20	30	25	4.00	25
Engines, gas or oil	10	20	15	6.67	25
Exhauster, shavings	15	25	20	5.00	20
Facer, nut	20	30	25	4.00	20
Forges, sheet metal	Field inspection entirely				10
Forges, cast iron	40	60	50	2.00	25
Furnaces	Field inspection entirely				10
Grinders, bench	20	30	25	4.00	20
Grinders, twist drill	25	35	30	3.33	20
Grinders, common dry	20	40	30	3.33	20
Grinders, common wet	20	40	30	3.33	20
Grinders, universal tool	20	30	25	4.00	20
Grinders, surface table	25	35	30	3.33	20
Grinder, machine tool wet	25	35	30	3.33	20

NORMAL SERVICE LIFE AND DEPRECIATION OF MACHINERY.—(*Continued*)

Class of machinery	Years life service range			Annual depreciation, per cent	Minimum service condition, per cent
	From	To	Average		
Grinder, planer knife	15	25	20	5.00	20
Gainer, car	25	35	30	3.33	20
Generators, elect	15	35	25	4.00	20
Hammer, steam	25	35	30	3.33	20
Hammer, power	25	35	30	3.33	20
Header, bolt	20	30	25	4.00	20
Heater, feed water, sheet	15	40	25	4.00	20
Heater, feed water, cast	20	30	25	4.00	20
Hoist, plain pneumatic	15	25	20	5.00	20
Hoist, chain	5	20	12½	8.00	20
Hoist, pneumatic geared	5	15	10	10.00	20
Jointer, wood hand	30	40	35	2.86	20
Key seater	25	35	30	3.32	20
Lathe, brass finishing	20	30	25	4.00	20
Lathe, turret	20	30	25	4.00	20
Lathe, engine	20	35	27½	3.64	20
Lathe, tool room	20	40	30	3.33	20
Lathe, bolt	20	35	27½	3.64	20
Lathe, wood turning	25	40	32½	3.08	20
Mill, vertical boring and turning	25	35	30	3.33	20
Mill, horiz. boring and turning	25	35	30	3.33	20
Miller, plain	25	35	30	3.33	20
Miller, planer type	25	35	30	3.33	20
Miller, universal	25	35	30	3.33	20
Miller, vertical	25	35	30	3.33	20
Motor electric as follows					
In wood working shops	15	25	20	5.00	25
In blacksmith shops	10	20	15	6.67	25
In machine and boiler shops	10	25	18	5.56	25

Note.—For A.C. squirrel-cage motors add 15 per cent to average life

Moulder, inside or outside	25	35	30	3.33	20
Matcher and planer, wood	25	35	30	3.33	20
Mortiser, vertical or horiz	25	35	30	3.33	20
Machine, sand papering	30	40	35	2.86	20
Machine, pattern core box	30	40	35	2.86	20

NORMAL SERVICE LIFE AND DEPRECIATION OF MACHINERY.—(*Continued*)

Class of machinery	Years life service range			Annual depreciation, per cent	Minimum service condition, per cent
	From	To	Average		
Machine, flooring	25	35	30	3.33	20
Machine, testing	25	75	50	2.00	25
Machine, centering	10	20	15	6.67	20
Machine, screw	15	25	20	5.00	20
Machine, dowel	35	45	40	2.50	20
Machine, sewing	10	20	15	6.67	20
Machine, saw and dade	25	35	30	3.33	20
Machine, taper belt	20	30	25	4.00	20
Press, pneumatic forcing	20	30	25	4.00	20
Press, hand screw	30	40	35	2.86	20
Press, hydraulic flanging	25	35	30	3.33	20
Punch and shear, power	25	40	32½	3.08	20
Planer, metal	25	40	32½	3.08	20
Planer, plate	25	40	32½	3.08	20
Planer, wood	25	35	30	3.33	20
Pumps, locomotive air	15	25	20	5.00	20
Pumps centrifugal	15	25	20	5.00	25
Pumps, steam boiler feed	20	40	30	3.33	25
Pumps, steam, low head	20	30	25	4.00	25
Pumps, triple power	20	30	25	4.00	25
Pumps, fire	20	40	30	3.33	25
Pumps, pumping engines	20	40	30	3.33	25
Pumps, vacuum	20	30	25	4.00	25
Rolls, taper, spring cut	20	30	25	4.00	20
Rolls, plate bending	25	35	30	3.33	20
Rolls, angle iron	25	35	30	3.33	20
Riveters, hydraulic, stationary	20	40	30	3.33	20
Riveters, pneumatic stationary	20	40	30	3.33	20
Riveters, hydraulic, portable	20	40	30	3.33	20
Riveters, pneumatic portable	20	40	30	3.33	20
Rattler, brass or iron	15	25	20	5.00	20
Resaw, timber	20	30	25	4.00	20
Reservoir, air	15	35	20	5.00	20
Receiver, air	15	35	20	5.00	20
Shear and punch, power	25	40	32½	3.08	20
Saw, cold—power	20	30	25	4.00	20
Saw, power—hack	20	30	25	4.00	20
Saw, wood rip	30	40	35	2.86	20
Saw, wood—cut off	25	40	32½	3.08	20
Saw, wood band	25	40	32½	3.08	20

NORMAL SERVICE LIFE AND DEPRECIATION OF MACHINERY.—(*Continued*)

Class of machinery	Years life service range			Annual depreciation, per cent	Minimum service condition, per cent
	From	To	Average		
Saw, universal rip and cut off	25	40	32½	3.08	20
Slotter, metal	20	35	27½	3.64	20
Shaper, pillar	20	35	27½	3.64	20
Shaper, transverse	20	35	27½	3.64	20
Shaper, craw cut	20	35	27½	3.64	20
Shaper, wood	30	40	35	2.86	20
Separator, oil	15	25	20	5.00	20
Separator, magnetic metal	15	25	20	5.00	20
Surfacer, wood	25	35	30	3.33	20
Sharpener, saw	15	25	20	5.00	20
Tapper, nut	20	30	25	4.00	20
Tenoner, wood	25	35	30	3.33	20
Trimmer, wood	30	40	35	2.86	20
Worker, universal wood	25	35	30	3.33	20
Piping, shaving, exhaust galvanized, sheet iron	15	25	20	5.00	20
Piping, power house	20	40	30	3.33	20
Piping, in yards, black, underground uncovered in cinders	5	10	7½	13.33	20
Piping, in yards, galvanized underground uncovered in cinders	5	10	7½	13.33	20
Piping, in yards, galvanized underground uncovered in black or sandy soil	15	35	25	4	20
Piping in yards, black uncovered on surface	5	25	15	6.67	20
Piping in yards, galvanized uncovered on surface	5	30	17½	5.71	20
Piping in yards, black covered overhead	20	30	25	4.00	20
Piping in yards, black uncovered overhead	15	25	20	5.00	20
Piping in yards galvanized covered overhead	20	30	25	4.00	20
Piping in yards, galvanized uncovered overhead	15	25	20	5.00	20
Piping in yards, cast underground	20	40	80	1.25	20

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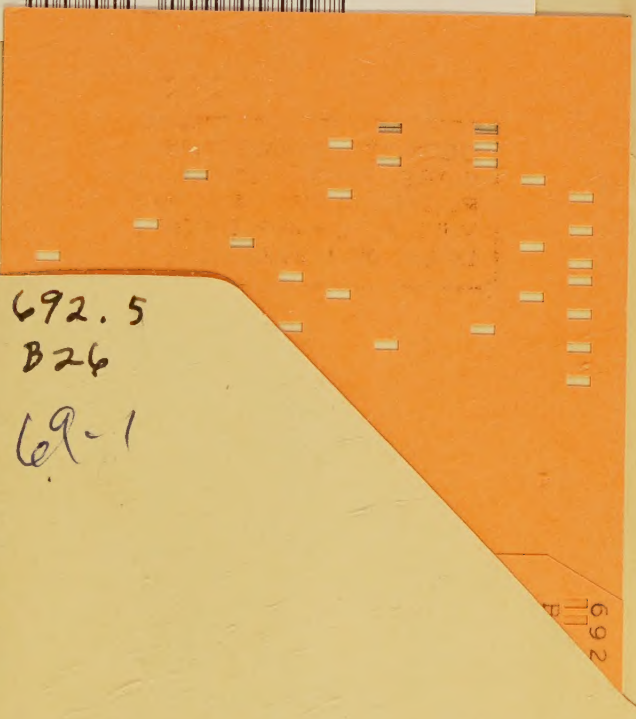

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